The Electrical Industry's Weekly Magazine September 11, 1961

Electrical World

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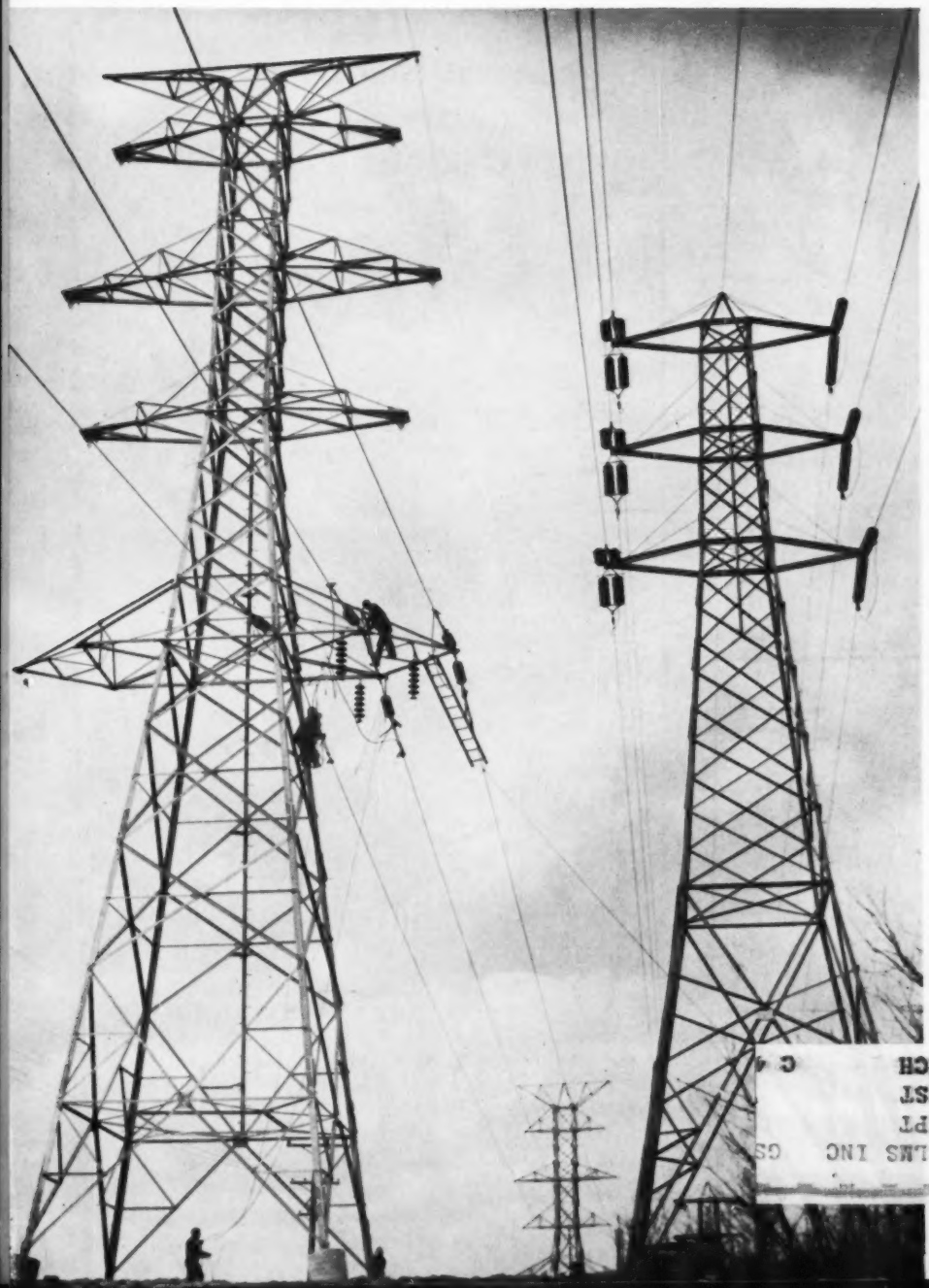
A McGraw-Hill Publication

Electric Utilities Map $8 Billion Transmission Plan...

...page 42



TURN-KEY: Pros and Cons (Part 2)

...page 71

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UNISPLICE®

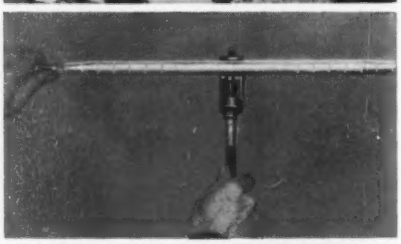
FULL TENSION HYSPLICE FOR ACSR

5 STEP 2-PIECE SPLICING

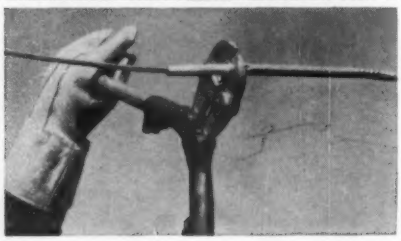
1. Aluminum strands must be carefully stripped back to the correct length. Care must be taken not to nick steel core.

2. Position of aluminum sleeve is marked on cable to facilitate subsequent centering over steel core. Lineman must then remember to slip aluminum sleeve onto conductor.

3. Steel sleeve is then crimped onto steel core.



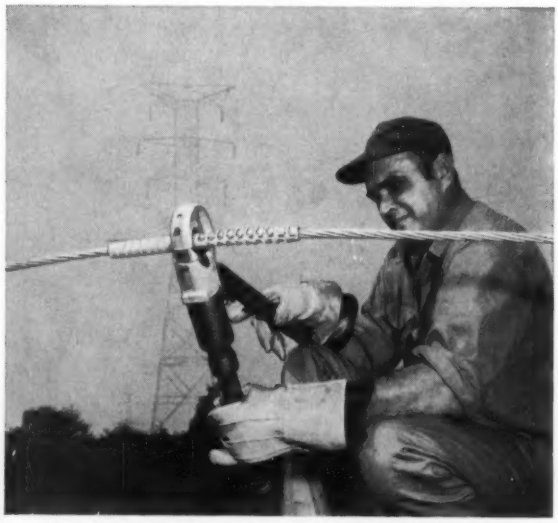
4. Aluminum sleeve is properly centered over steel core. PENETROX is pumped into aluminum sleeve thru filler hole.



5. Aluminum sleeve is finally crimped onto cable.

2-STEP UNISPLICING

1. Cables are inserted into one piece aluminum UNISPLICE.® No stripping, no marking or centering required.



2. Install UNISPLICE using BURNDY MD5-3 Hytool or Y35 Hypress. UNISPLICE is factory filled with PENETROX.®

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58-5

Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

September 11, 1961
Vol. 156, No. 11

Dateline . . .

Growing Co-op Buying Uintah Power & Light

Northeastern Utah—It appears that the citizens of Roosevelt, Duchesne and Myton may be destined to receive electric service from Moon Lake Electric Assn of Vernal. This is in spite of the fact that the city councils of all three communities wrote to REA Administrator Norman Clapp expressing their opposition to the acquisition of Uintah Power & Light Co by Moon Lake.

REA approved a $3,299,000 loan to Moon Lake. This provides the money for purchase of Uintah stock plus allowing for a new 1,500-kw hydroelectric plant, transmission and distribution lines.

Moon Lake simply outbid Utah Power & Light Co for the purchase of Uintah. Uintah's 1960 annual report showed a $1.034-million plant value, less $475,000 depreciation, leaving a $560,000 net value. Last year, UP&L offered a stock exchange deal that would have amounted to a purchase price of $800,000, which would have been about $140 a share. Moon Lake's successful offer was $1,250,000, or about $219 a share.

The cooperative is beginning to get a reputation for outbidding investor-owned utilities. The beginning of this was in 1958 when it was successful in bidding to serve Flaming Gorge construction camp.

On the third round of bids the Bureau of Reclamation awarded the contract for supplying the Flaming Gorge camp to Moon Lake, which bid $1,213,000 to Southern Wyoming Power Co's $1,267,634 (EW, July 14, 1958, p 46). A first-round bid in which Southern Wyoming was low was rejected by the Bureau, and a second round favoring Moon Lake was also thrown out. REA at the same time approved a $4.2 million loan to Moon Lake for construction of a 115-kv line for a 7,000-kw load at Flaming Gorge plus the attendant generation. Southern Wyoming protests were unavailing.

What is still not known by anybody but REA officials in Washington, is how the new loan to Moon Lake for purchasing Uintah was justified. Section II of the Rural Electrification Act states: "The administrator is authorized . . . to make loans . . . for rural electrification and the furnishing of electric energy

(*Continued on page 5*)

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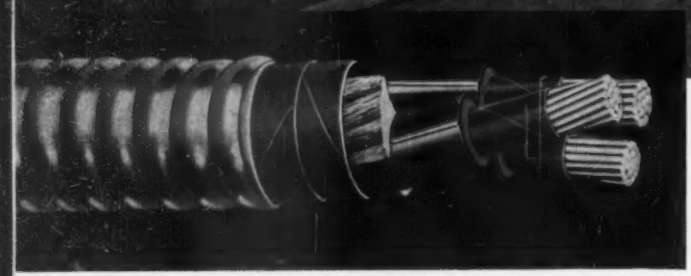

EASILY HANDLED—Neat, compact arrangement of 2300-volt power feeders shows how easily Loxarmor cables are handled. These circuits serve a new 15,000 kva "packaged" substation.

A LOOK INSIDE—This cut-away shows details of the quality construction that is part of every Loxarmor cable. An additional advantage is available in an Okoseal (polyvinylcholoride) jacket which can be supplied over and under the Loxarmor where environmental conditions warrant.

LOXARMOR®—the interlocked cable that bends itself to your will

You're the boss when you specify Loxarmor, Okonite's interlocked armor cable. Whether you require galvanized steel, aluminum, bronze or copper protection, Loxarmor is manufactured to your specifications. And Loxarmor cables are easily handled at both vertical and horizontal bends, as well as in crowded locations where circuits must be bent around piping and other apparatus.

Because of its installation economies, Loxarmor is finding increasing use in primary and secondary feeders, power and lighting circuits, station auxiliaries, control circuits, and motor circuits in place of rigid conduit systems.

Here are a few of the many advantages of Okonite Loxarmor cables:

Lower material and installation costs save money . . . additional circuits are easily added . . . circuits are easily rerouted . . . accessibility of Loxarmor reduces downtime . . . flexible, compact construction reduces space requirements. And the strict quality control under which Loxarmor is made, contributes to its continued record of superior service in the field. It all adds up to Okonite Cable'bility* —the ability to design and manufacture electrical cables that give outstanding performance.

To learn more about Loxarmor write for Bulletin EW-1090. The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

*Cable'bility . . . cable craftsmanship since 1878

***where there's electrical power . . . there's* OKONITE CABLE**

Dateline . . .

Northeastern Utah (*Continued from page* 3)

to persons in rural areas who are not receiving central station service . . ." Section XIII of the same act states: "As used in this act, the term 'rural area' should be deemed to mean any area of the United States not included within the boundaries of any city . . . exceeding 1,500 inhabitants . . ."

The city of Roosevelt was not only receiving central station service—it's population is closer to 1,800.

But these questionable factors, as those in the case of the Flaming Gorge bid, seem to have little effect on Moon Lake's ability to get financing.

Ironically enough, UP&L attempted for years to enter into some kind of mutually beneficial plan with Moon Lake and Uintah to put generation needed by all three in the Roosevelt—Duchesne—Myton area. Finally the utility gave up the idea and built a transmission line to the area to serve Vernal and the large San Francisco Chemical Co plant just to the north. UP&L's seemingly sound plan for cooperative generation did not satisfy Moon Lake's ambition to grow bigger.

The concerned citizens of the three communities will be the ones who will eventually pay the piper for Moon Lake's ambition. UP&L spokesmen say they serve their Vernal customers at a rate 28% lower than Moon Lake charges its rural customers, and 17% below Uintah's present rate to the three towns. It doesn't seem likely that Moon Lake's rates to the communities will be as low.

But all is not necessarily lost yet, for the citizens.

Even though Moon Lake is proceeding as if it will always serve the three towns, the fact is that each of them has a franchise agreement with Uintah, and all three expire at different times. As the situation stands now, each of the communities can go to the Utah Public Utilities Commission as their franchises expire and request that they be served by whatever utility they designate.

Letters

US Represented at Mexico City Seminar

To the Editor:

I follow with great interest your defense of investor-owned utilities in the US against ever-advancing federal power. It was a pity, therefore, that there were no observers either from your magazine or from said private utilities at the recent Latin American Seminar on electric power held in Mexico City under the sponsorship of CEPAL. On the other hand there were several delegates from TVA, Bonneville, Federal Power Commission—and Russia.

. . . it is very unfortunate that often we lose battles by default . . . and do not fight for our principles or beliefs.

R. J. Pedersen Y., EE
Ingeniero Electrico
Caracas, Venezuela

Our report on the Latin American Seminar (EW, Aug. 28, p 42) appeared just after Reader Pedersen had written his letter. We do appreciate his comments, but want to note that our Electrical World correspondent and representatives of investor utilities were on hand in Mexico City for the seminar.

Longest Single Span River Crossing

To the Editor:

On page 32 of July 31 *Electrical World* is an article describing the Hudson River crossing of a new transmission line linking Con Edison, Orange & Rockland to the ESUPRA pool. In the first paragraph an incorrect statement is made that this is the longest [4,275 ft] single span river crossing in the East.

May I call your attention to a previous article by F. W. Packer and myself in the July 19, 1947, *Electrical World* describing a 5,367-ft span constructed by Pennsylvania Power & Light Co over the Susquehanna River.

C. H. Schofer, Transmission Engineer
Pennsylvania Power & Light Co
Allentown, Pa.

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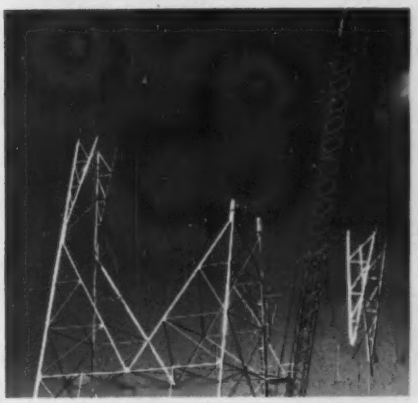

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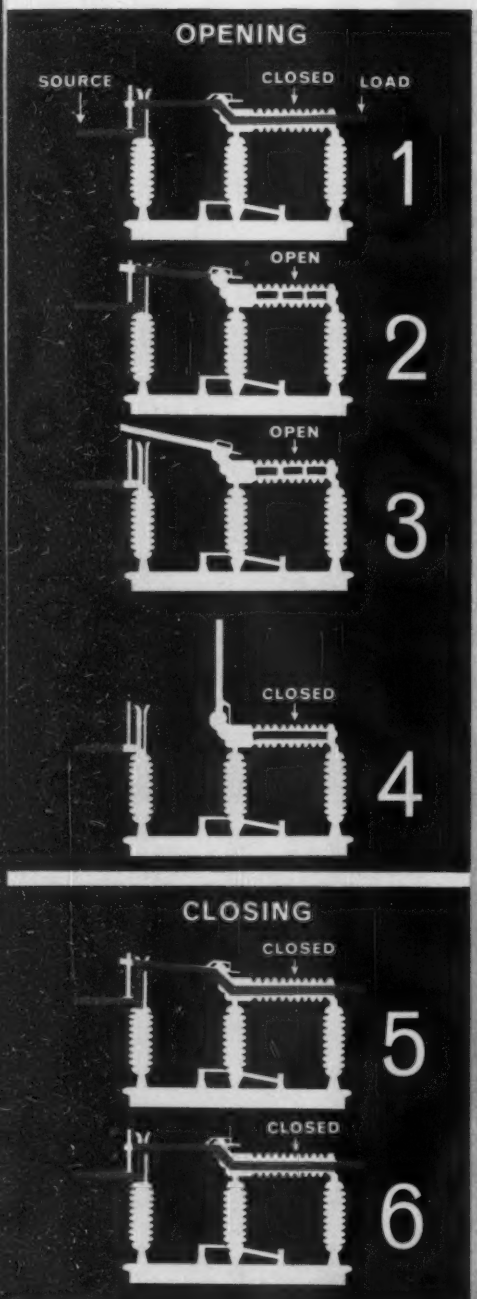
Works like a circuit breaker—looks like an interrupter switch



This is Circuit-Switcher. Costs less than a circuit breaker. Outperforms an interrupter switch.

Circuit-Switcher is the generic name for a new family of switchgear for handling a number of circuit interrupting duties on transmission systems. It's a cross between an interrupter switch and a circuit breaker. A significant feature of Circuit-Switcher is that it is mechanically programmed to fit high-voltage switching environments, whether breaking or making the circuit.

PROGRAMMED CIRCUIT BREAKING

1 When Circuit-Switcher is in the closed position, the interrupting section carries the continuous current and withstands short-time surges—like a breaker.

2 As Circuit-Switcher starts to open, the "brain" mechanism (with its built-in sequence control and stored energy) trips the interrupting section, opening the circuit—like a breaker.

3 Now the "brain" moves the disconnect blade toward the open position to establish a visible air gap—like an interrupter switch. But unlike an interrupter switch, the blade is not burdened with shunting, actuating, and driving an interrupting unit.

4 As the disconnect blade approaches the fully open position, the "brain" recloses and recocks the interrupting section, unlike the interrupter switch which must recock at the most adverse loading point in its closing cycle.

PROGRAMMED CIRCUIT MAKING

5 As "brain" closes the blade, inrush current (or fault current) is picked up at the jaw . . . not in interrupting section. Unlike the interrupter switch, the blade closes at high speed, unimpeded by having to reclose and recock an interrupting unit.

6 Circuit-Switcher is completely closed—ready for the next opening cycle.

With the guts to do the job

Like a circuit breaker, Circuit-Switcher's vital close and trip mechanisms are fully enclosed and protected. Unlike an interrupter switch, there is no gingerbread—no external shunts, triggers, cams, and levers—to freeze up, burn up, jam up, or goof up.

Operation is "Goof-Proof"

The correlation of interrupting section action, disconnect blade action, and operating handle action is pre-scheduled by the "brain" mechanism. Any operating procedure—such as reversing direction in "midstream"—will not result in improper sequencing of interrupting section and disconnect blade.

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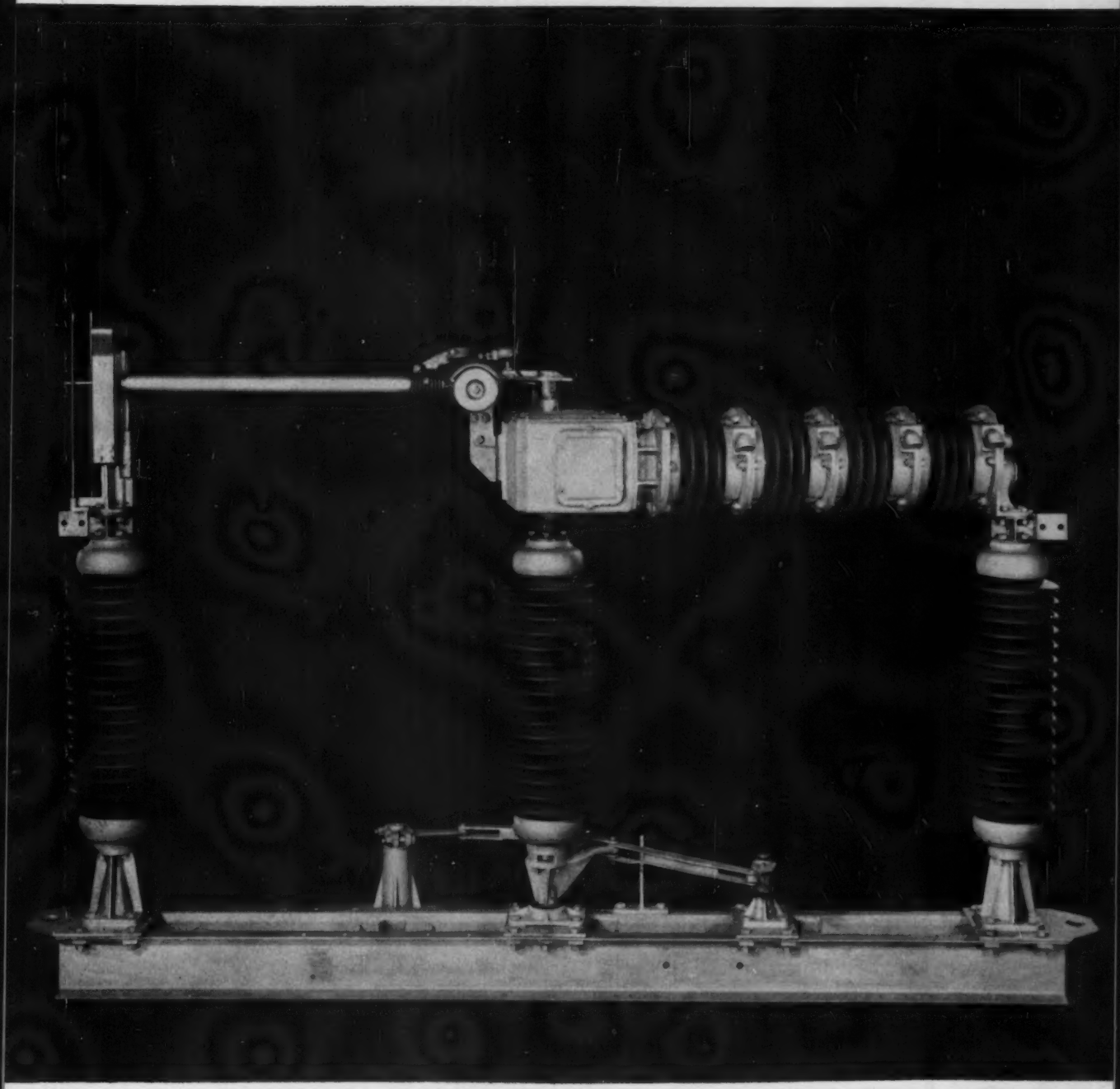
4421 Ravenswood Ave. • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911



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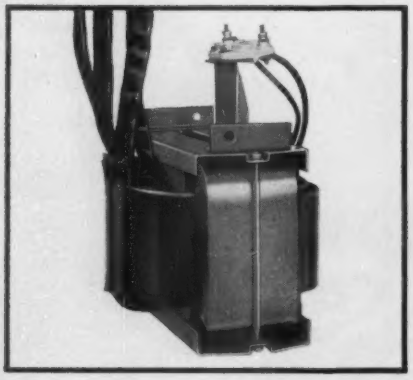
Delta-Star DS-50★ Distribution Transformers

***DS-50—Delta-Star's new design with minimum short-circuit capability of 50 times rated current.**



The New DELTA-STAR DS-50 embodies two major advances in Distribution Transformer Design:

1. Aluminum Strip Low Voltage Winding
2. New Porter Core

Aluminum strip windings provide increased short-circuit capability, reduced hottest-spot gradients, and contribute to lower over-all weight, reduced dimensions, and longer life.

The Porter Core, through the application of a new concept in core fabrication, provides better regulation and also contributes to over-all weight and size reduction.

featuring the new

STRESS-FREE PORTER CORE

A new and unique method of fabrication, exclusive with Delta-Star, now makes it possible to produce a STRESS-FREE core yielding TOROID PERFORMANCE from a rectangular configuration. Delta-Star puts the space tolerance where it belongs—IN THE CORNERS, providing a HIGH SPACE FACTOR in the straight portions of the core. This makes for minimum weight, minimum coil dimensions and minimum impedance.

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Improved magnetic properties mean smaller cores for the same losses, and smaller cores lead to reduced impedance and better regulation.

Percent Regulation @ 0.8 PF 7200/12470Y

	10	15	25	37½	50
Old	1.80	1.70	2.05	1.85	1.70
DS-50	1.70	1.70	1.70	1.60	1.55

Because the DS-50 can save your company a considerable amount of money, we urge you to evaluate it. Prove to yourself the immediate savings it offers. An evaluation will convince you that your company should be purchasing the DS-50 Distribution Transformer.

Write for complete details to: *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois.*

PORTER ***DELTA-STAR ELECTRIC DIVISION***
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Type 316

Type 316

story of two bolts...

Both of the bolts shown above were used on the *same* application, in the *same* factory, and faced the *same conditions*.

The bolt on the left is a Harper type 316 Stainless Steel bolt shown after three years of service. The bolt on the right is another manufacturer's bolt, identified as type 316 Stainless Steel, shown after only three months of service.

The dramatic fact that the Harper bolt lasted twelve times longer (and is still in service) is proof of Harpers' metallurgical control of alloys from "billet to bolt" in our completely integrated factory. Harper's corrosion-resistant fastenings, immediately available in a wide range of alloys and sizes, assure you that *your* products will be built to last no matter what the application may be.

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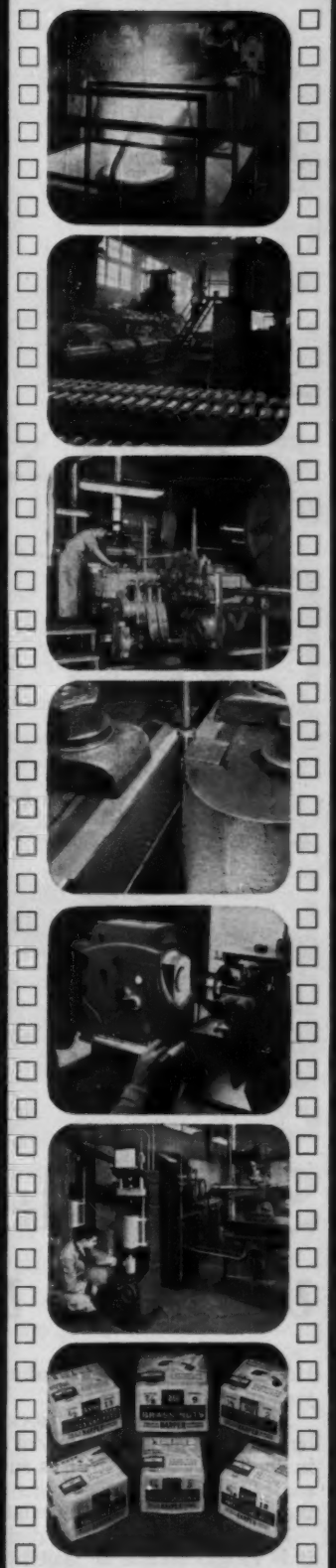

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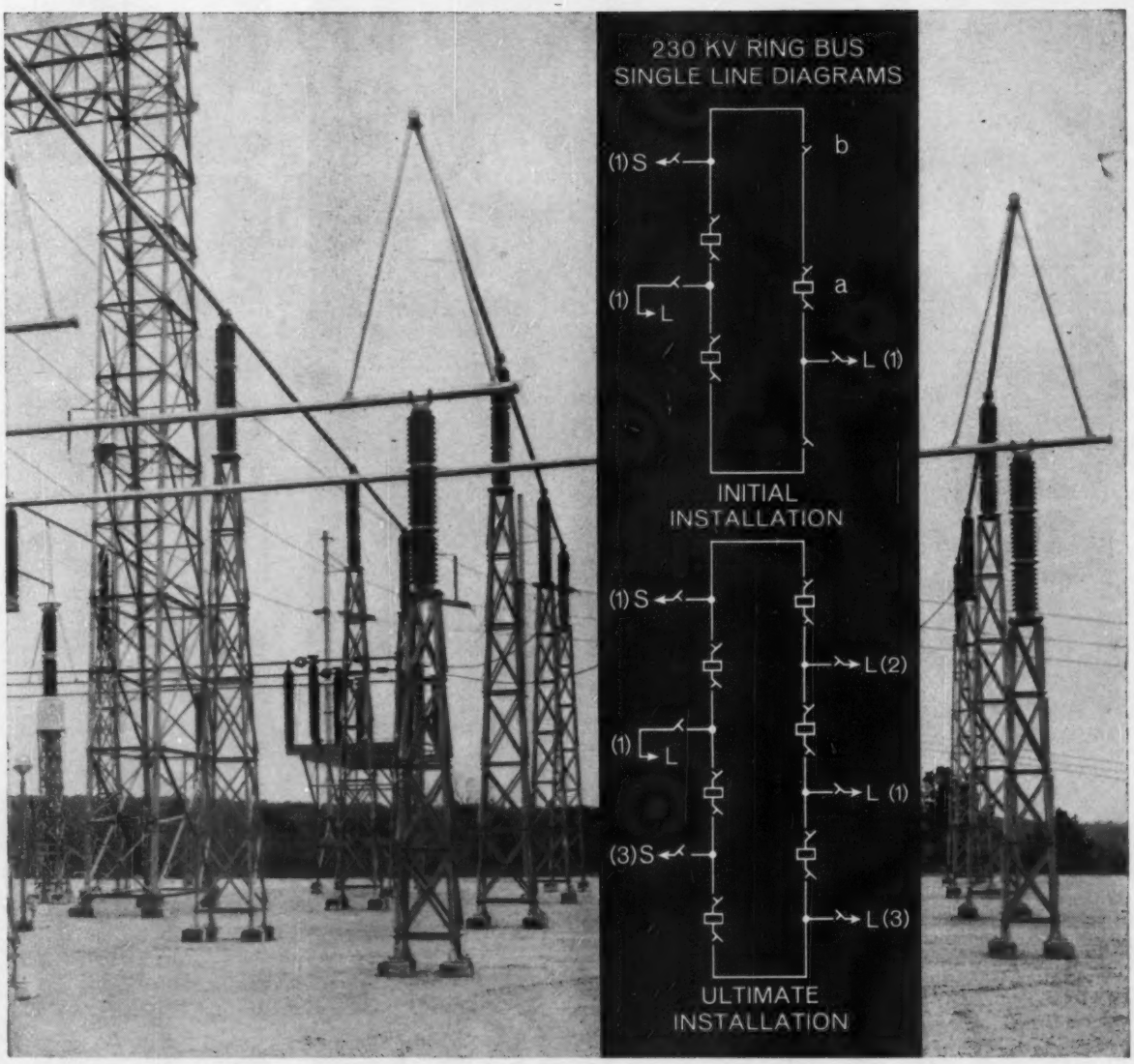

Spend less now... expand later *without interrupting service*

How? By designing Alcoa® aluminum rigid ring bus into your next switching station.

Like this one—the Goat Rock Substation—engineered by Georgia Power Company of Atlanta. As a key station in the utility's system, this substation was given unusually thorough engineering review. Nothing less than the best in design and material could be considered.

Even a quick look at the diagram will show how easy it is to add source or load lines without interrupting service. In the initial installation, one source line energizes a ring bus from which two loads are supplied. To add a third load (2), open the breaker "a" and switch "b". In this way the additional breaker and isolating switch can be installed without any high-voltage hazard to construction personnel.

Further expansion involves adding a new source line and a fourth load line (3). This will be accomplished in the same manner as adding load line (2). Naturally, bays must be constructed for installing lines at (3).

That's the story: Reliability, expansion without interrupting service, lower initial cost. All accomplished with Alcoa aluminum rigid bus.

More facts? See your usual source of Alcoa materials. Or write to Rome Cable Division of Alcoa, Dept. 1-91, Rome, New York.

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"There's a lot of bull work for the guys who string up high lines. Any 'labor-saving' methods are sure appreciated by us linemen.

*"These new Lapp **Hi-F** suspension insulators weigh a third less than the 10" discs we've always used before. That difference between 52 pounds and 77 pounds for a string of seven units means a lot out on the end of a crossarm!*

*"The smaller shell diameter of **Hi-F** makes it easier to get at, too, for putting on the hardware."*

Ease of handling in the field, warehousing and trucking is just one advantage of Lapp's modern ***Hi-F*** suspension insulator. A 'compact-model' high-efficiency unit, it costs less to make, so costs less when you buy it. Rated at 14,000 M&E strength, it matches in all other mechanical and electrical values the standard (EEI-NEMA-52-3) 10" suspension insulator. Matches it too, in quality and assurance of long life. Forward-looking management, purchasing, engineering and operations endorse Lapp ***Hi-F*** as enthusiastically as do the construction boys!

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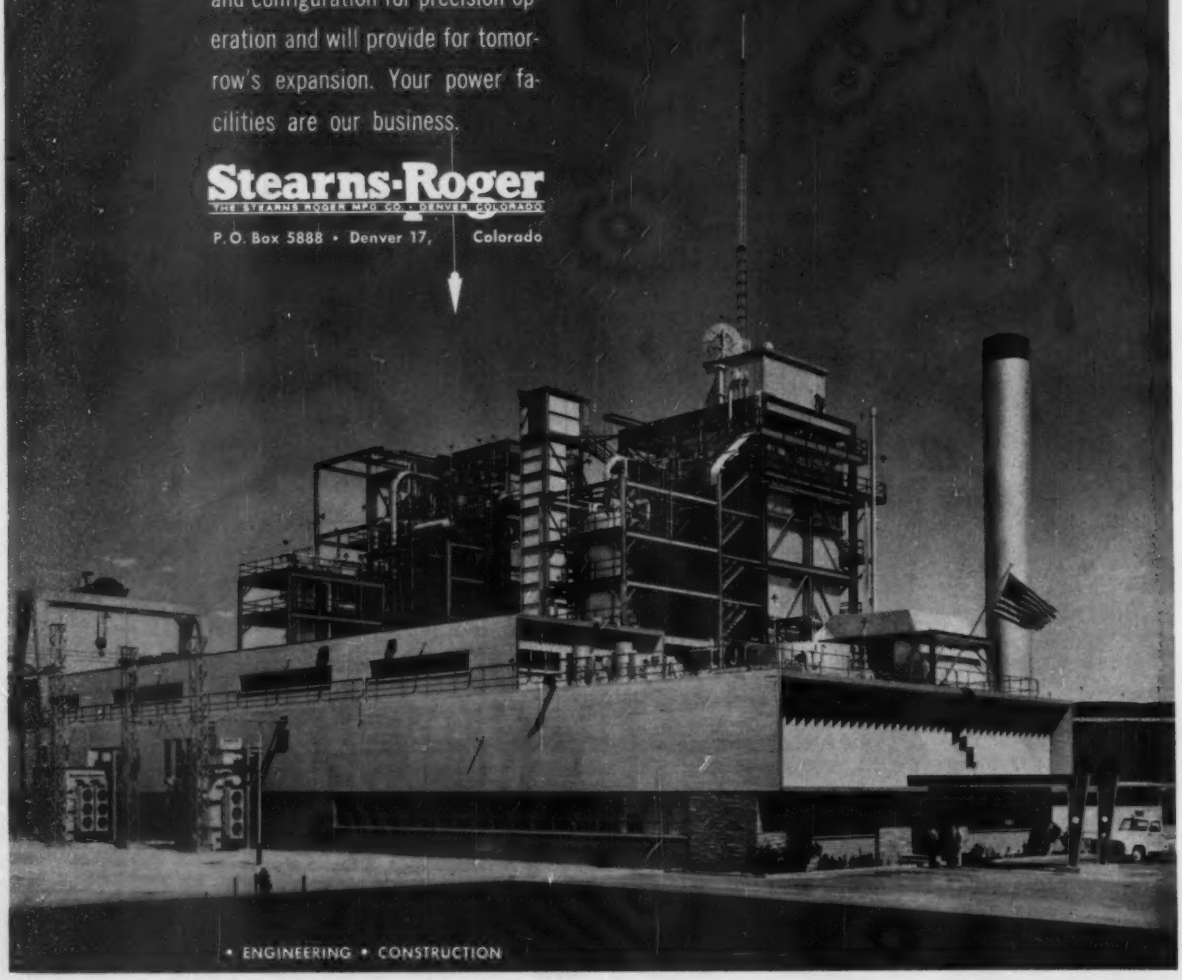

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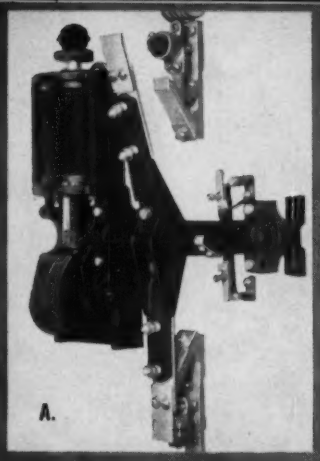

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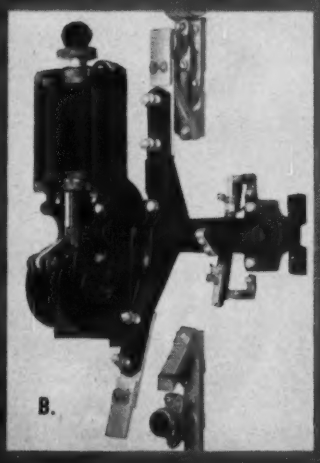

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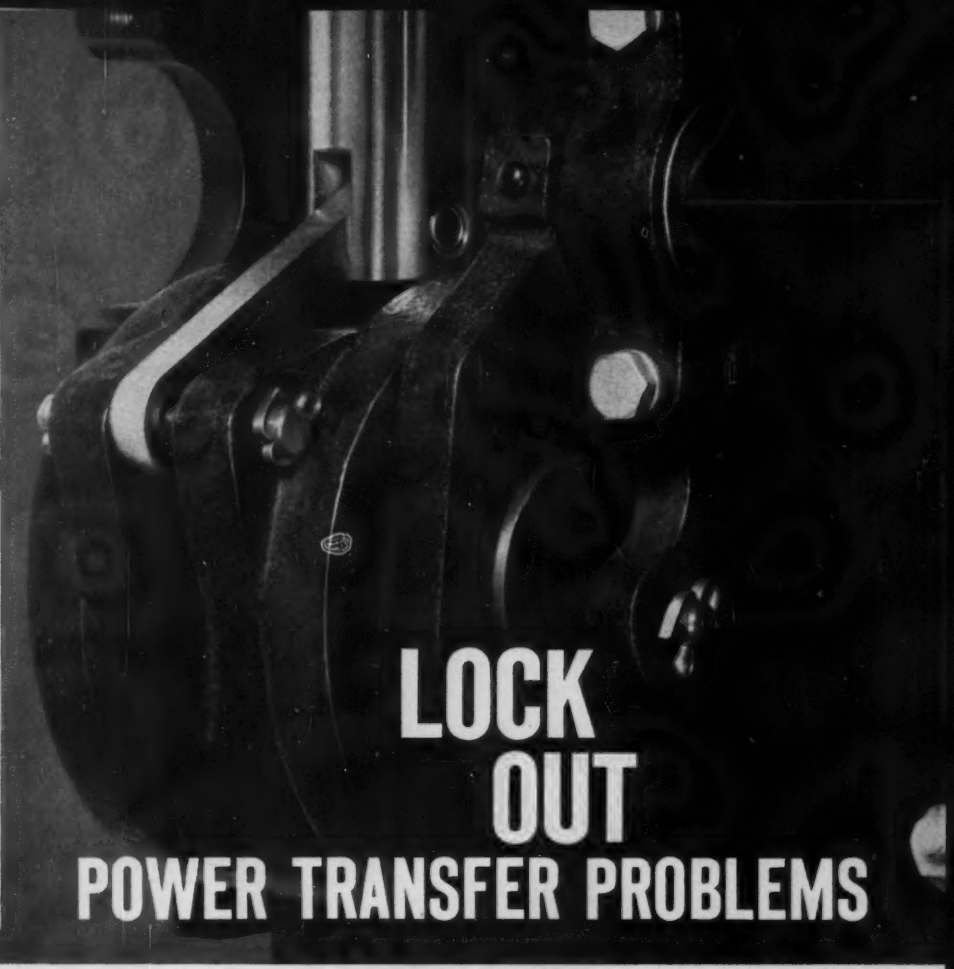


LOCK OUT POWER TRANSFER PROBLEMS

With Inherently Interlocked ASCO Transfer Switches

A. Normal Position... Solenoid is not energized. Angular relationship of connecting linkages locks rotating weight and main contacts rigidly in position. Only momentary actuation of solenoid can realign linkages and rotate weight to change switch position.

B. Emergency Position ... After rotation of weight, angular relationship of linkages locks weight and main contacts in new position. Solenoid is no longer energized. Mechanically rugged movement has no hooks, latches, or semipermanent magnets.

Any transfer switch which will allow normal and emergency contacts to open or close simultaneously is a potential source of serious trouble. In the former case the load is disconnected from both power systems, and in the latter, the two power systems are shorted together. In either event the faulty switch actually causes the condition of total power outage it is intended to prevent.

In contrast, the mechanism of an ASCO Mechanically Held Automatic Transfer Switch is inherently interlocked. The powerful movement, shown above, rigidly restricts the switch to one of two possible positions. The movement can not be dislodged accidentally; at all times the switch is locked in position by powerful mechanical linkages which totally eliminate movement or play of the contact arms. Only energization of the solenoid can change the position of the switch.

This unique mechanical locking system constantly maintains heavy contact pressure too, thus minimizing I^2R losses and eliminating accidental contact separation from vibration or other causes. Additional features include: wide break distances; positive make ability; and high short time fault current ratings. Dependability of the entire transfer switch is further enhanced by the rugged, single-solenoid ASCO design.

The extensive ASCO line includes a mechanically held automatic transfer switch to meet *your* requirements: 30 to 2000 amperes ... to 750 volts ... in standard or special ratings.

Catalog 57-S1 and Publication 596, available on request, show you how to select the optimum switch for your specific needs.

ASCO Electromagnetic Control

ASCO

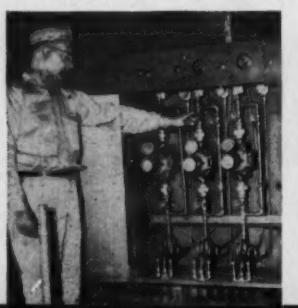
DEPENDABLE CONTROL BY Automatic Switch Co. 50K HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • *AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL*

ANOTHER

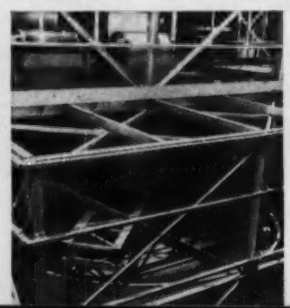
EASTERN CLEANING PLANT NEARS COMPLETION

This centrifugal dryer is one of the methods used at Keystone to control moisture.

Maintenance foreman adjusts control panel of the automatic oil treating machine.



Magnetite is thickened here before being returned to the heavy media washer.



Heavy media washer cleans the coarse coal—effectively reduces ash.

The expansion of the coal cleaning plant at Eastern Gas and Fuel Associates' Keystone mine located in McDowell County, West Virginia, has reached the point where much of the new equipment is already in test operation.

The additional facilities at Keystone will include heavy media washers, a heavy media cyclone, froth flotation cells with their associated filtering equipment, and low-head drain and rinse screens, with centrifugal drying facilities. These additions permit Keystone to provide the best low volatile coals available today.

Designed by Eastern's own engineering staff, the Keystone plant is the second in a series of new or modernized coal cleaning plants now under construction. Another similar project is in the planning stage.

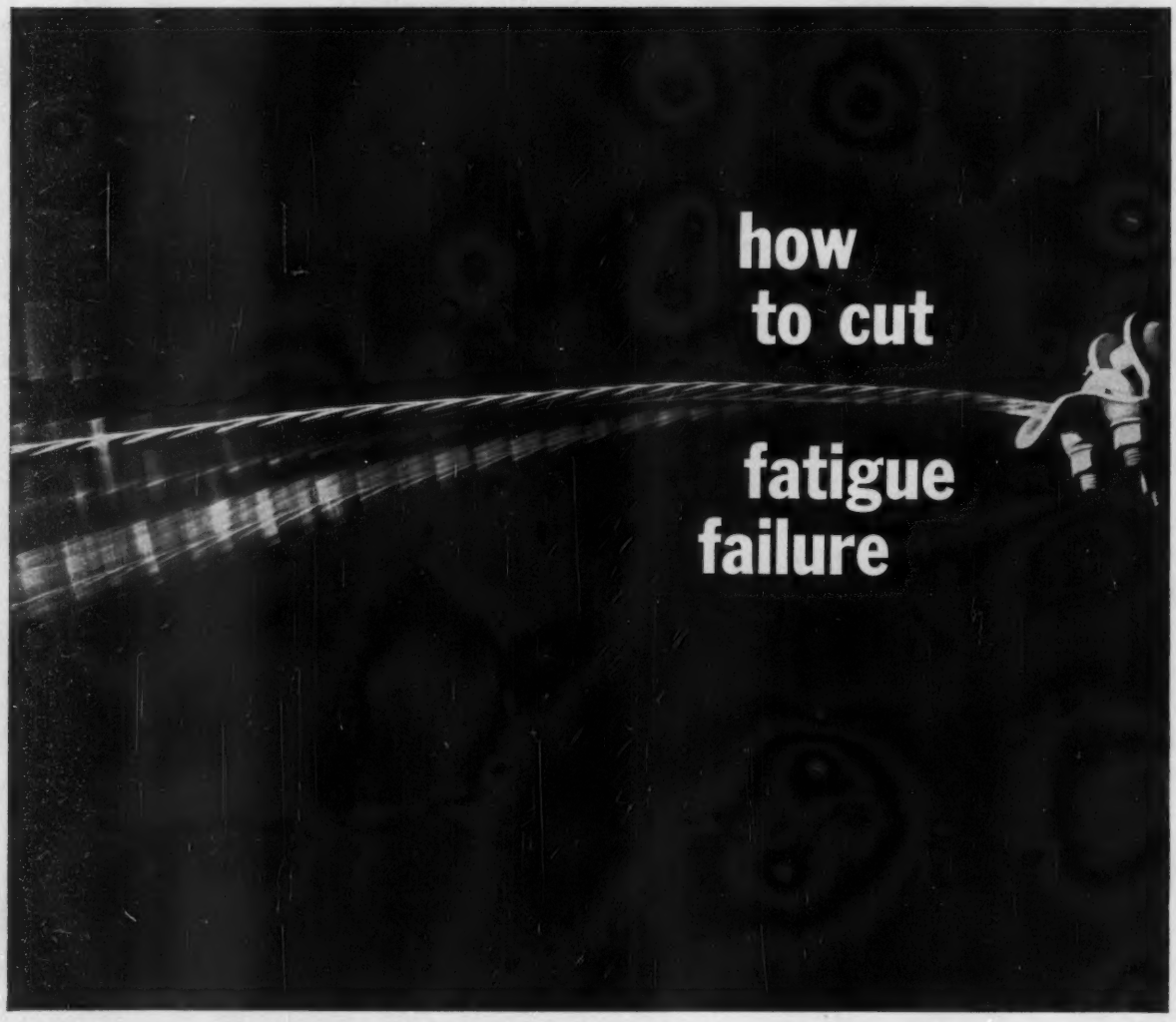
These plants are evidence of Eastern's determination to continually improve their product and their service to customers. Call any Eastern Representative for information on the wide variety of Eastern coals.

Eastern Coals and Eastern Customer Service can help you conserve your fuel dollars.

EASTERN GAS AND FUEL ASSOCIATES

BOSTON • BUFFALO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK
NORFOLK • PHILADELPHIA • PITTSBURGH • SYRACUSE

EASTERN GAS AND FUEL ASSOCIATES
BEACON COAL



USE TOUGH STEEL STRAND WITH BETHANIZED COATING

for Strength
. . . Economy
. . . Versatility

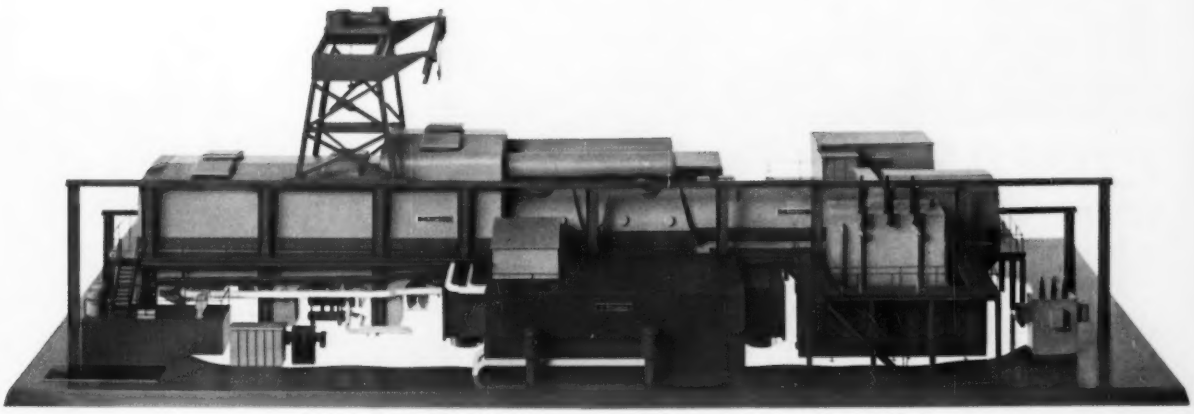
An overhead ground wire vibrates every time the wind blows briskly. And that vibration is destructive. It causes fatigue stresses which ultimately cause weakening and failure.

Bethanized strand provides maximum resistance to fatigue failure. Here's why: the steel wires themselves are selected to provide extra strength and toughness. But that's not all. The smooth, uniform coating of pure electrolytic zinc on each wire provides excellent corrosion-resistance, as well as better fatigue-resisting characteristics than other types of coated wire.

Bethanized strand is also available in four different coating weights. Thus you can get exactly the right corrosion-protection for each individual installation. The nearest Bethlehem sales office will gladly give you full details.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
Export Sales: Bethlehem Steel Export Corporation. *Distributor:* Joslyn Mfg. & Supply Co.

BETHLEHEM STEEL



NOW—WESTINGHOUSE
POWER ISLAND
DESIGN PERMITS
REDUCED PLANT
INVESTMENT FOR
100 TO 500 MW
GENERATING UNITS

COMPACT POWER ISLAND COMPONENTS ARE KEY TO LOW FOUNDATION & INSTALLATION COSTS

The Power Island concept which Westinghouse helped pioneer in cooperation with Texas Electric Service Company offers an opportunity to make substantial savings on power plant costs wherever it can be applied. Power Islands contain turbine generator, heat transfer apparatus, switchgear, power transformer and associated control equipment—all engineered as a package. The result is an extremely compact assembly of apparatus arranged to minimize necessary piping and wiring, and to eliminate bus work. What is more, Westinghouse produces more "island" equipment than any other single manufacturer and is in the best position to integrate components to produce lowest cost.

SAVINGS ARE TANGIBLE

The Power Island can reduce plant investment by:

- Permitting completely above grade installation.
- Minimizing foundation requirements through use of tandem-compound turbine.
- Reducing piping, valving, conduit and wiring.
- Combining equipment such as main and auxiliary power transformers in a single tank.
- Elimination of low-voltage isolated phase bus.

Arrangement of the Westinghouse Power Island is ideally suited to outdoor installations with savings in building costs. Even where shelter is necessary, efficient layout will permit reduction in overall plant size and crane span.

POWER ISLAND DESIGN FLEXIBILITY ASSURES MOST EFFICIENT HEAT CYCLE

The Power Island concept assures integrated layout and design for both turbine and heat transfer apparatus. The heat cycle can be optimized within the framework of your operating specifications.

Next, the integrated Power Island design lends itself perfectly to full automation using the Westinghouse PRODAC*-IV digital control computer. PRODAC-IV can operate equipment directly during startup, operating and shutdown sequences—as well as perform computing, data logging, scanning and alarm functions to aid personnel in safe, reliable and efficient plant operations under all conditions.

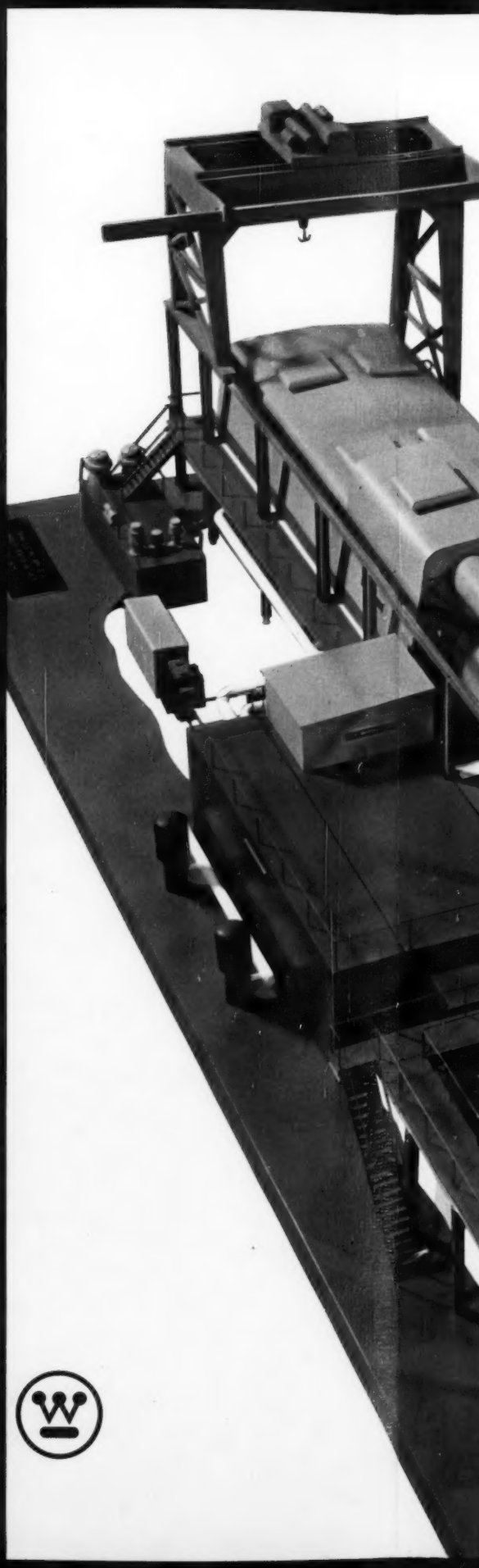
Finally, Westinghouse maintains steam division representatives in all major cities who will be glad to discuss the application of the Power Island design to generating facilities you have planned. These men are able to evaluate your information to make sure that any final proposal is complete.

For further information on the Westinghouse Power Island design, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

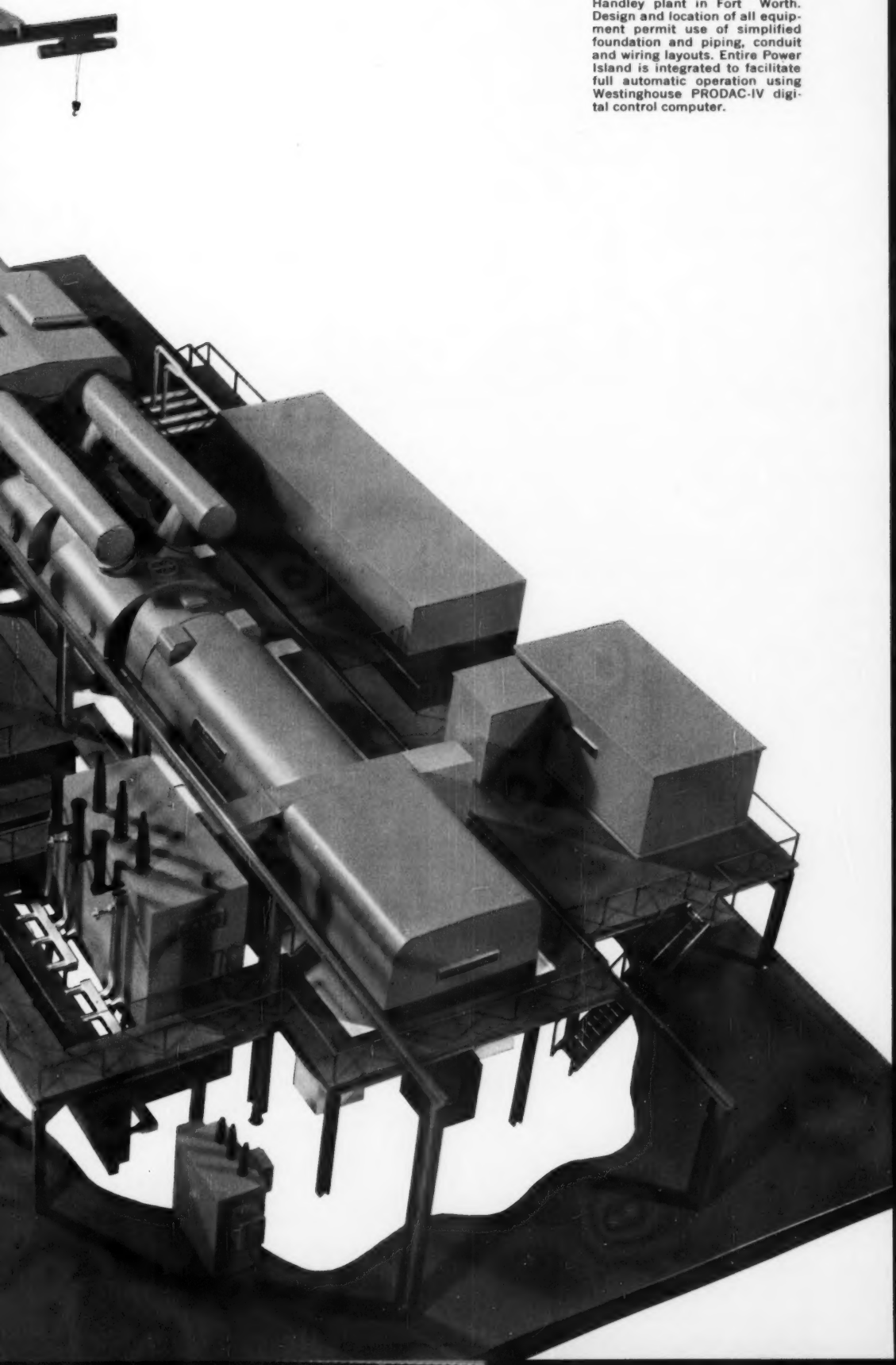
*Trademark

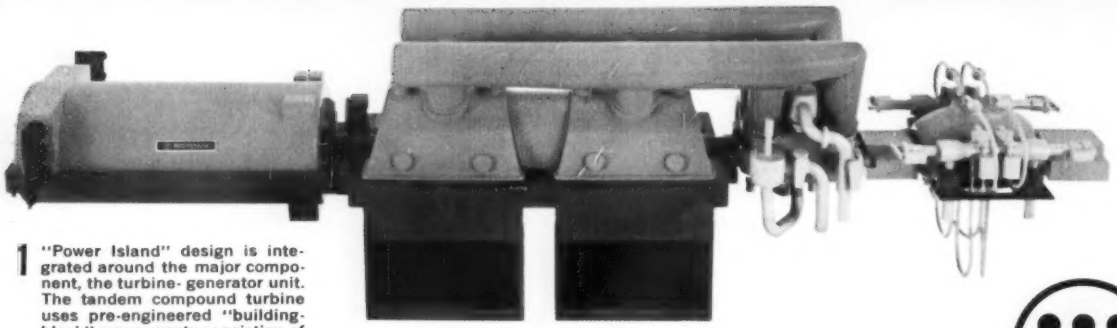
You can be sure . . . if it's

Westinghouse



Model shown is of actual "Power Island" unit for 350 megawatt steam plant purchased by Texas Electric Service Company at its Handley plant in Fort Worth. Design and location of all equipment permit use of simplified foundation and piping, conduit and wiring layouts. Entire Power Island is integrated to facilitate full automatic operation using Westinghouse PRODAC-IV digital control computer.

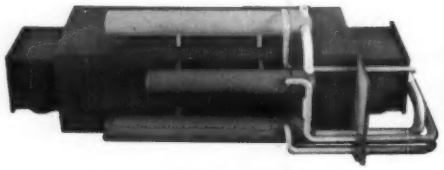




1 "Power Island" design is integrated around the major component, the turbine- generator unit. The tandem compound turbine uses pre-engineered "building-block" components consisting of a high pressure element, intermediate pressure element and low pressure elements.

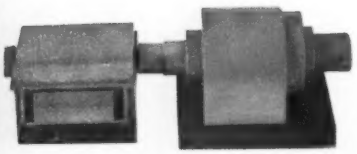
Westinghouse

2 Generator is hydrogen-cooled and THERMALASTIC insulated. Side mounted bushings permit close coupling of generator and power transformer to eliminate bus work and reduce over-all plant area.



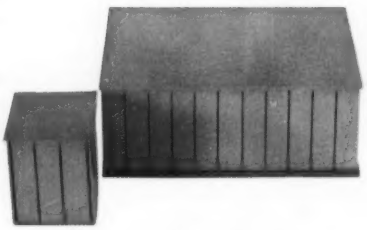
3 Use of two side inlet, single pass, radial flow, deaerating condensers allows low pedestal height with major reduction in foundation and piping. Completely welded, high pressure feedwater heaters with clad tube sheets are located to achieve further savings in space and piping.

4 Flash evaporator with integral low-pressure feedwater heaters form a single structure below the turbine. Unit provides all make-up for system.

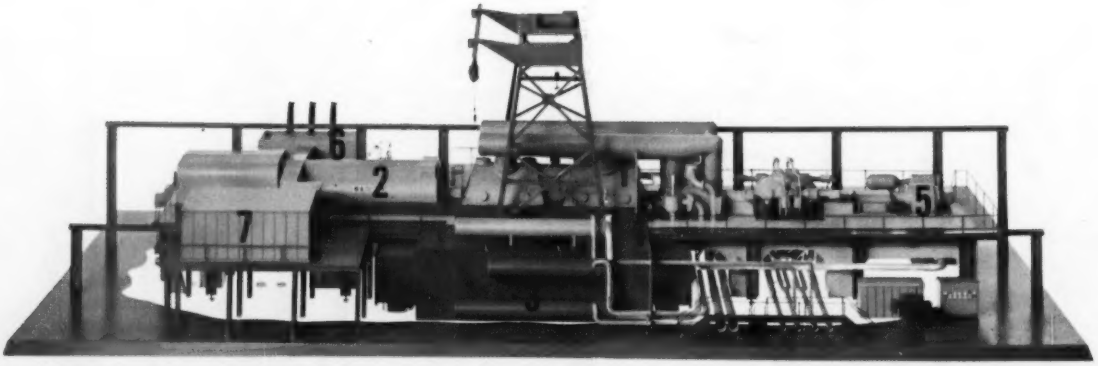


5 Main shaft-driven boiler feed pump simplifies plant layout, reduces condensate piping and enables unit to operate through low frequency and/or low voltage surge conditions.

6 Main transformer is close coupled to generator to minimize plant size and eliminate isolated phase bus. Auxiliary power transformer is included in same tank in isolated compartment.



7 Switchgear, located close to transformer, controls station auxiliaries. Shelterfor-M* enclosure provides weather protection. Outdoor power and motor control centers are strategically located to operate plant auxiliaries.



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CP-1084

Electrical World

SEPTEMBER 11, 1961
Vol. 156, No. 11

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NEXT WEEK

DON'T MISS the 12th annual electrical industry forecast

LATE NEWS ▶ **House Appropriations Committee whittles $69.5-million** from Pres Kennedy's budget requests for rivers and harbors, flood control, Bureau of Reclamation and several federal power programs. Over all, the $3.6 billion approved is about $110.7 million below last year's appropriations. Bureau of Reclamation and Corps of Engineers water resources programs were allotted $960.4 million for 436 projects that would eventually cost the government about $17 billion. Bonneville Power Administration is allotted $33.08 million, a cut of $1 million. Southeastern Power Administration request of $800,000 is left intact, as is that of Southwestern Power Administration for $2.3 million.

San Diego Gas & Electric Co announces intent to participate with Southern California Edison Co in procurement and operation of automated, nuclear-fueled 375-Mw generating plant at a site midway between San Diego and Los Angeles. Westinghouse will design and, with Bechtel, build the plant.

Federal Power Commission orders Alabama Power Co to show cause why it should not comply with two 1960 orders, amending company's 1957 license to build several hydro projects on Coosa River. The 1960 order deleted an unbuilt 44-Mw Wetumoka Project, substituted a 225-Mw Jordan No. 2 Project. Alabama Power is also directed to show cause why license application for plant on Black Warrior River should not be denied. Failure to comply with 1960 order is cited as reason to dismiss Black Warrior application.

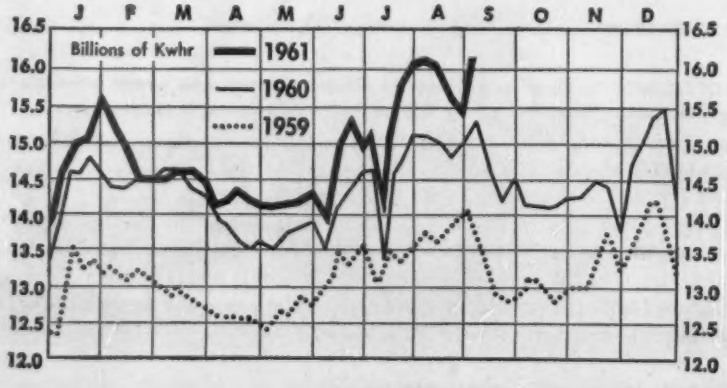
A "Northwest Economic Development Committee" has been named and appointed by Interior Secretary Stewart Udall to carry out two-year study of basic resources and growth potential in Bonneville Power Administration general area. Representatives of federal and state agencies, as well as customers of Bonneville, are named to committee. BPA Administrator Charles Luce says committee will make "intensive study" of selected industries.

International Atomic Energy Agency report says that 150 to 200-Mw nuclear plant being considered for Luzon Island in Philippines may be competitive with conventional plant of equal size.

Westinghouse announces new line of potential transformers, 25 through 69 kv, to be priced $80 to $160 cheaper than Type OPT line it supersedes.

US power output in week ending Sept. 2 hits all-time high of 16,214,000,000 kwhr. Scorching weather in eastern half of country gets the credit. Previous peak, in week ending Aug. 5 of this year, was 16,137,000,000 kwhr.

WEEKLY POWER OUTPUT—Up 5.6% (Week ending Sept. 2), Kwhr 16,214,000,000



Per Cent Change From Previous Year

	Aug. 19	Aug.26	Sept. 2
Total U.S.	+ 5.4	+ 3.1	+ 5.6
New Eng.	+ 4.6	+ 8.4	+ 8.9
Mid. Atlan.	+ 4.6	+ 6.4	+ 9.4
Cent. Indust.	+ 4.0	− 0.6	+ 3.1
West Cent.	+ 8.9	− 1.8	+ 4.8
Southeast	+ 3.0	+ 3.1	+ 5.9
South Cent.	+11.7	− 2.8	+ 1.7
Rocky Mount.	+ 5.8	+11.0	+ 8.3
Pacific			
NW	+ 2.5	+ 1.6	+ 2.4
SW	+ 8.3	+14.7	+10.2

Seasonally Adjusted Index 296

Week Ago 284 Year Ago 282

Source: Edison Electric Institute

Supply Lines

WHAT CAUSES PURCHASING AGENTS TO BUILD UP INVENTORIES?

Why do purchasing agents build up inventories? To get an answer to that question, the National Assn of Purchasing Agents recently put the question to its members, for NAPA says it believes that the key to the next strong movement in the economy would be the inventory policy of purchasing executives.

From the answers received, it appears that the two strongest forces affecting inventories are the threat of a strike in vendors' plants and lengthening of "lead time" on materials. Some 73% of those purchasing agents queried say they will add to inventories if they anticipate a work stoppage; and a like 73% will add when they see vendor lead time lengthening.

Third place goes to anticipated price increases, NAPA finds. Some 62% report they would add to inventories when they felt sure of commodity price increases. However, the remaining 38% say anticipated price increases would have little effect on their inventory policies.

When asked whether a worsening international situation would affect their inventory policies, some 53% answered "no," but the remaining 47% answered "yes."

For the immediate situation, NAPA reports that a "surprising 45%" of the PA's queried say they expect no increase in inventories in the foreseeable future. However, a slightly larger percentage, 46%, report they plan to add to inventories over the next six months, and, over half of these in the next 60 days. A small 9% plan further reductions in present stocks.

This special survey on inventory policies was part of a regular monthly report on general business conditions, which, in August, were again said to show "snap and vitality after the summer lull during June and July." The purchasing executives indicate in their August report that "the steady climb upward, noted since February, once more appears to be gathering momentum, with a strong movement for the better likely within the next 60 days. None appear willing to call it a 'boom' in the making, but rather a return to normal healthy business."

MANUFACTURERS FAVOR CANADA, LATIN AMERICA FOR OVERSEAS SPENDING

US electrical machinery manufacturers plan to spend $118 million on overseas capital expenditures in 1962, a comprehensive survey by the McGraw-Hill economics department shows. This is somewhat less than the $134 million planned for this year, but more than the $104 million actually spent in 1960.

While the electrical machinery category is a broad one and includes not only utility equipment but also appliances, industrial electrical products, etc., the survey does give some interesting clues concerning the industry's overseas spending plans, which represents 7% to 8% of the total spent by all US manufacturing industries.

Electrical machinery manufacturers are putting an increasingly larger portion of their money into Canada, 35%, 42% and 55%, in the years 1960, 1961, and 1962 respectively. On the other hand, the total representing all US manufacturing industries is going the other way: 29%, 21%, and 18%.

Latin America is also getting more stress from electrical manufacturers than from

all manufacturing. The percentages for the years 1960-61-62 are 14%, 30%, 26% for electrical manufacturers, while 15% 16%, 18% for all manufacturing.

The European Common Market, on the other hand, is receiving a decreasing emphasis from the electrical manufacturers: 29%, 20%, 10%. For all manufacturing, the reverse is true: 27%, 31%, 33%.

And for the rest of Europe, there is a somewhat similar picture: 22%, 8%, 9% for electrical manufacturers, and 19%, 22%, 19% for all manufacturing.

For the rest of the world, including areas such as Asia and Africa, the McGraw-Hill survey shows *no* capital expenditures by US electrical manufacturers during the 1960-61-62 period, while for all manufacturing the figures are 10%, 10%, 13%.

A 9% boost in exports from the US in 1962 is also predicted by electrical machinery manufacturers, compared to a 3% hike for all manufacturing over the previous year. For electrical manufacturers, this means over $900 million in export sales in 1962 compared to almost $800 million in 1960.

KEFAUVER TO ASK FOR COMPANIES' DIVISIONAL PROFIT AND LOSS FIGURES

The Senate Antitrust & Monopoly Subcommittee says it will subpoena 1954-1960 divisional profit and loss statements of General Electric Co and Westinghouse Electric Corp. This is the latest step in some quiet bickering that has been going on between the Subcommittee and the companies. It also represents a retreat by the Subcommittee, which is headed by Sen Estes Kefauver (D-Tenn.). Earlier, the Subcommittee had subpoenaed more detailed departmental profit and loss statements, but the companies balked. Whether the companies comply this time is an open question, but they have until next Jan. 10 to decide.

BRITAIN'S LARGEST ELECTRICAL UNION OUSTED FROM FEDERATION

Britain's largest electrical union, representing workers in both the manufacturing and utility field, was expelled last week from the country's labor federation, the Trades Union Congress. Reason for the ouster is that in June a British court ruled that five Communist officials (including the president) of the 240,000-member Electrical Trades Union had rigged the union's elections which resulted in eight out of 11 members of the executive council being Communist controlled, although only 1% of the rank and file were Communist Party members.

The federation subsequently sent the union an ultimatum demanding that new elections be held and that the five Communist officials be barred from office for at least five years. When the union executive council rejected these demands, the federation took the drastic step of ousting the union and urging all the union members to vote in elections later this month, with the hope that a non-Communist executive council will result.

At the same time, the case has strongly revived demand for legislation in Britain to outlaw union officials' abuse of power. A bill is being prepared which would lay down precise rules for union administration and appoint an independent body to which individual union members could appeal against coercion and persecution.

We'll show you proof of savings!

Conductor side-sway is an important factor in the design of high-voltage transmission lines.

On a conventional 230-kv line with free-swinging suspension strings, conductor sway at the structure necessitates an additional 35 feet of width in the right of way, an additional 10 feet of crossarm width, and an additional 10 feet of structure height. These requirements are correspondingly higher at higher voltages.

If conductors are restrained by V-strings, significant savings can be achieved in right of way, structures, and maintenance - - and electrical performance of the line can also be improved.

If you'd like more detailed information, send for O-B publication number 1503-H, "High Voltage Line Economies With V-string Insulators."

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LET'S TALK FUSE LINKS

■ Outwardly most fuse links look very much alike . . . but there the similarity ends! What, then, makes Kearney Fuse Links more dependable . . . more accurate than others? ■ Let's start with construction. All Kearney Fuse Links feature LOW temperature fusible elements and de-ionizing fibre lined tubes. Temperatures inside fuse tube and cutout cartridge always remain well below the fibre charring point . . . even after prolonged service overloads. Thus, the all-important fibre is not impaired by excessive heat . . . fuse tube and cartridge retain their original strength and arc-quenching capabilities necessary for positive full-range fault interruption ■ The exclusive de-ionizing fibre lining and extra strength of the Kearney fuse tube, in effect, make the Kearney Fuse Link a cutout within a cutout when interrupting fault currents up to 600 amperes.* Extra-long, tough, moisture and weather resistant tube provides a longer de-ionization path to clear low faults faster, more positively . . . will not warp or hang up in cartridge. Fuse tube and top terminal are securely joined to prevent loss of expulsion gas pressure ■ Select components, rigid quality control, exhaustive laboratory and substation testing guarantee strict adherence of Kearney Fuse Links to published T-C curves. For positive system protection and accurate co-ordination . . . specify Kearney Fuse Links . . . Standard or Specialized.

*An average figure varying with different fuse ratings.

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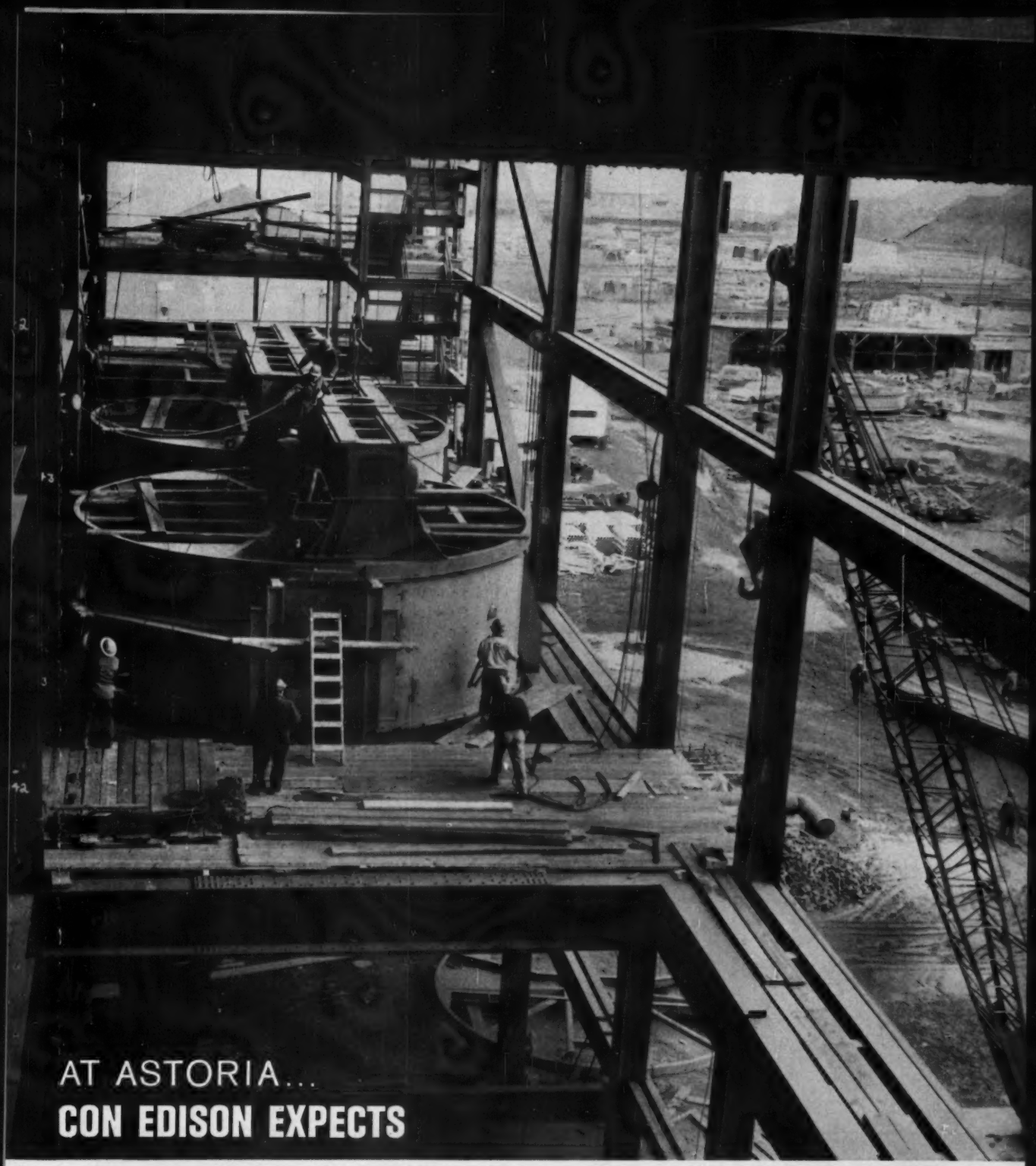

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CON EDISON EXPECTS

FUEL SAVINGS OF 8% FROM FOUR NEW LJUNGSTROMS®

Four new Ljungstrom Air Preheaters are being installed by Consolidated Edison Company of New York, Inc., on their Astoria Stations' #50 boiler unit. With a total heating surface of about 547,000 sq. ft., these four units are designed to reduce the stack temperature 345° F. By transferring this heat to the incoming combustion air, a fuel savings of about 8% is realized. Addition of these units makes a total of 16 Ljungstroms installed at Astoria . . . 77 either installed or on order in the entire Con Edison system.

Our engineers will be glad to recommend ways to improve your operating results on new or existing fuel fired units. For information, please write to:

THE AIR PREHEATER CORPORATION

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NEW economy | NEW safety | NEW efficiency

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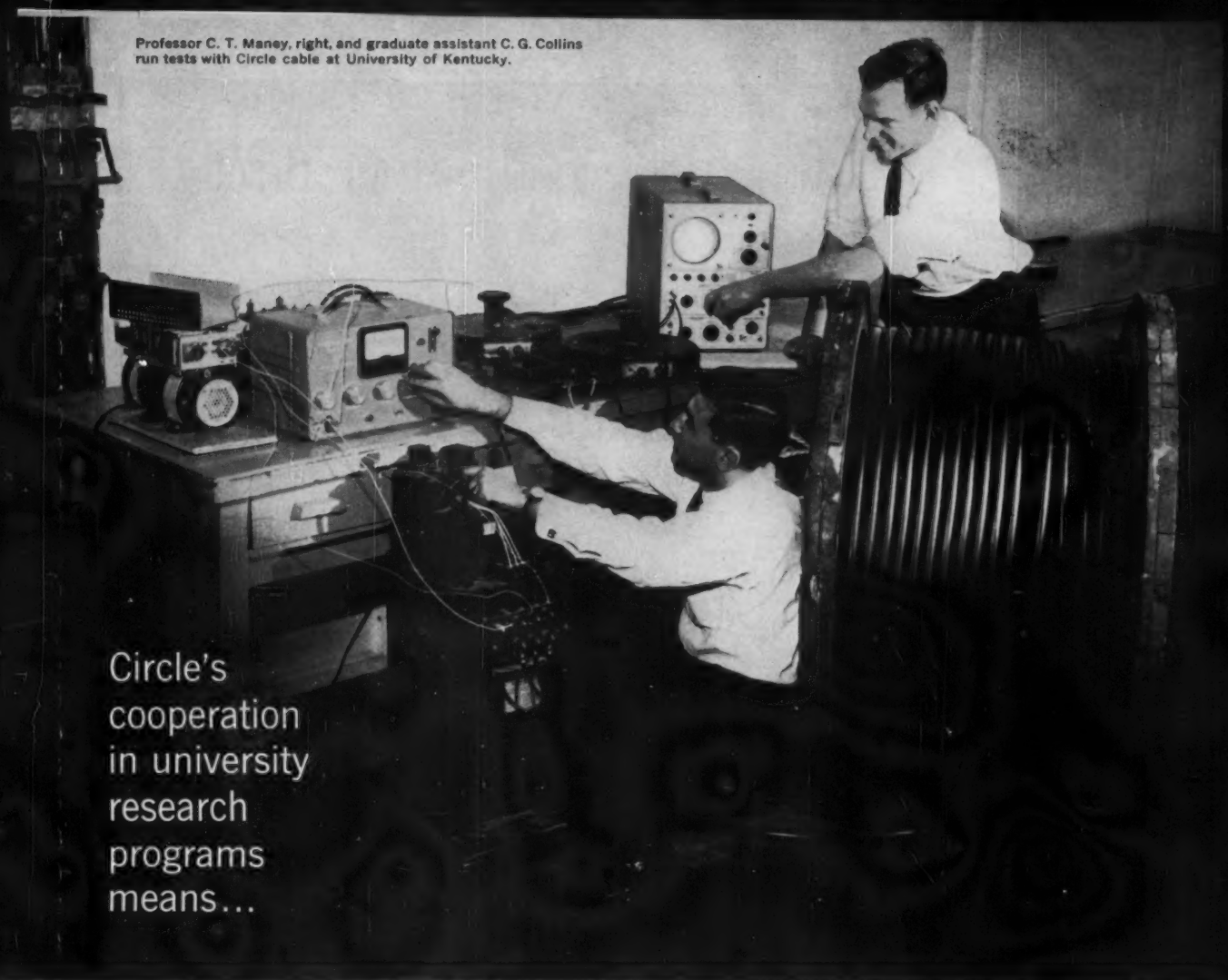
Payload	1,000 pounds
Engine	Hurricane, 4 Cyl. F-Head, 72 hp.
Wheelbase	81 inches
Overall Length	154 inches
Load Space Volume	170 Cu. Ft.
Interior Height Rear Load Area	62½ inches
Length of Load Area	87½ inches
Interior Width Load Area	57 inches

Here's the newest, most economical walk-in delivery van you can buy—the sensational new 'Jeep' Fleetvan. Ideal for multi-stop delivery use! The Fleetvan parks easy. Maneuvers easy. New safety-designed front lets the driver see the road just a short way in front of the bumper. And the Fleetvan gives top gas economy too. These are just a few of the reasons the U. S. Post Office purchased over 6,000 'Jeep' Fleetvans. For full information on the 'Jeep' Fleetvan write to Mr. R. J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.

'Jeep' FLEETVAN

WILLYS MOTORS, INC., TOLEDO, OHIO. ONE OF THE GROWING KAISER INDUSTRIES



Professor C. T. Maney, right, and graduate assistant C. G. Collins run tests with Circle cable at University of Kentucky.

Circle's cooperation in university research programs means...

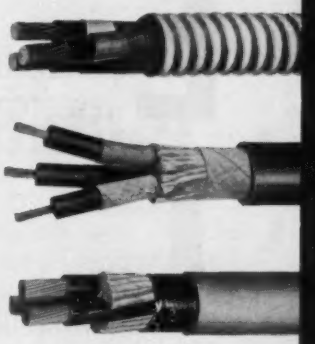
CABLE THAT MEETS TOMORROW'S NEEDS

Electrical engineering research programs being conducted in colleges and universities are vital to the continued progress of our industry.

Circle Wire & Cable is glad to cooperate fully with the universities to help assure the success of their projects. Circle has supplied reels of cable on a loan basis to a number of colleges engaged in the development of basic data on the behavior of cable under unusual conditions. At the University of Kentucky, for example, tests are being conducted, using Circle multiconductor cable, to develop basic data on skin effect and proximity effect on cable operated at 400 to 600 cps, 3 phase loading.

The results of these University of Kentucky tests and other basic research data developed in university laboratories contribute significantly to better cable design. This is the goal we continually strive for at Circle.

Specify Circle cable on your next job ...there's no finer cable made.



CIRCLE WIRE & CABLE CORP.

SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE • PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT

B rush control

A rbor specialists

R ight-of-way clearance

T ree surveys

L ine clearance

E xperimental research

T ree trimming

T echnical consultation

More than 13 years ago Bartlett successfully pioneered the use of the helicopter for shade tree spraying—an operation that was to lead the way, a few years later, to a new efficient method of control of woody plants along utility rights-of-way.

At first, difficult terrains presented unusual problems but gradually through research and experience, new equipment was developed and new herbicides and techniques perfected to overcome them. Today, Bartlett research in this important field is carried on continuously through college fellowships and at the Bartlett Research Laboratories.

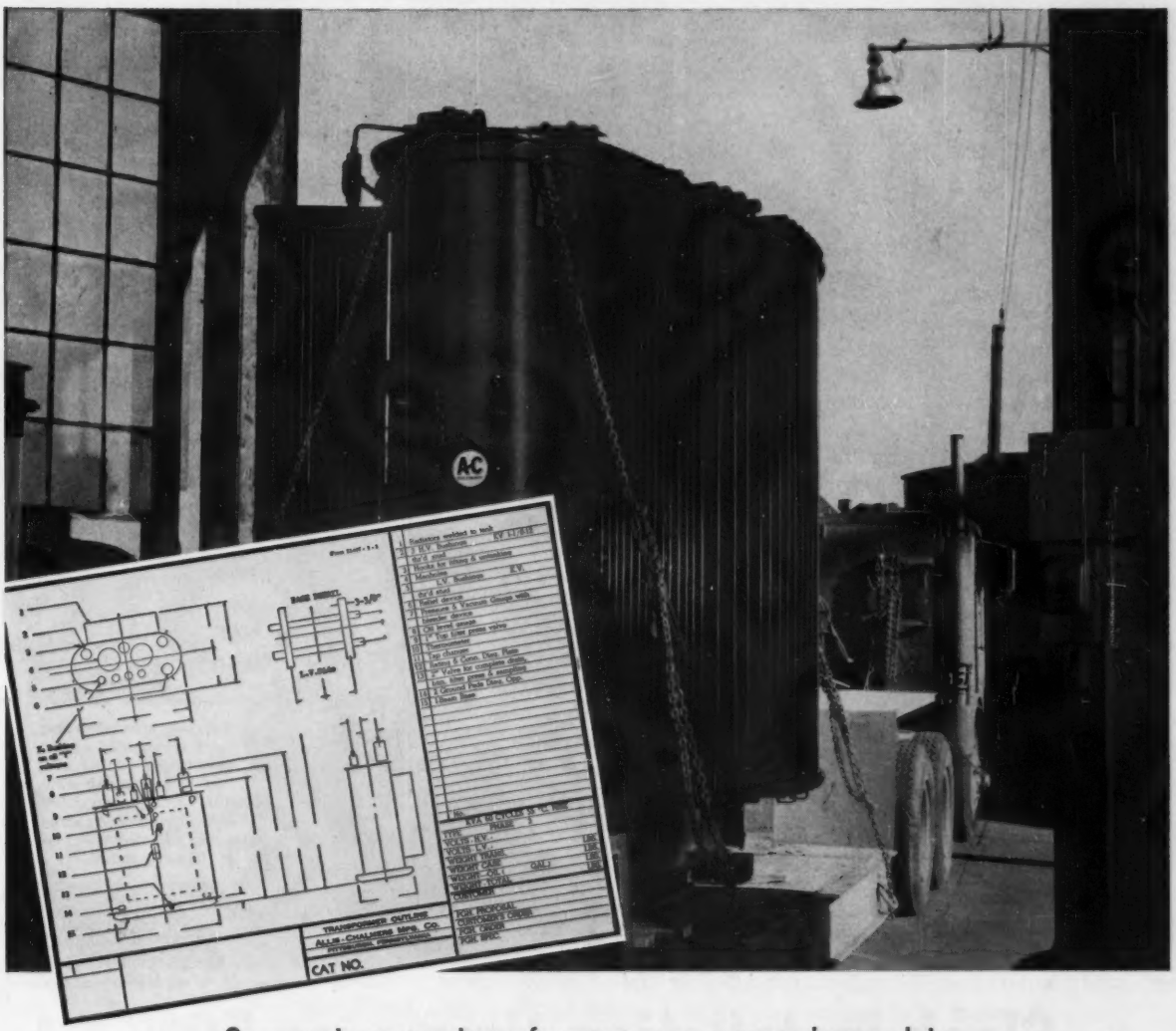
If your right-of-way clearance, line trimming, brush control or tree survey requirements present a problem, we invite you to share our years of experience. This service is now available from Maine to Florida, and west to Illinois and Alabama.

BARTLETT TREE EXPERTS

Home Office, 2770 Summer Street, Stamford, Conn.
Research Laboratories and Experimental Grounds, Stamford, Conn.

ALLIS-CHALMERS

A-1437



Compact power transformers are pre-engineered to

simplify your station planning!

Advance engineering information for customers — actual outline drawings (shown above) with certified dimensions and weights — is sent with every A-C small power transformer quotation. With this information, you can *immediately* plan your station layout — figure foundation sizes, mounting details. No time-consuming preliminary engineering.

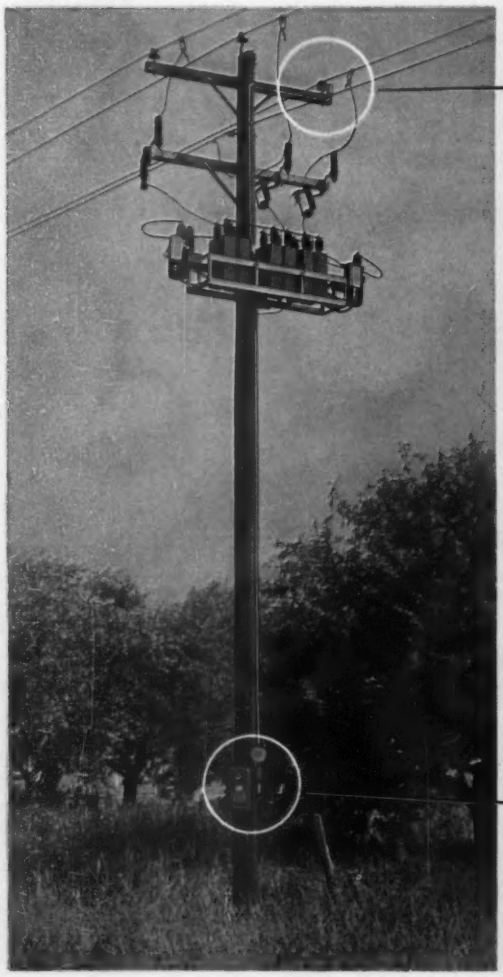
And no delivery delays! Pre-engineered major components are stocked. Your small power transformers are scheduled for manufacture as soon as your order is received. Installation costs are lower too. Low height—easier handling due to low center of gravity. Less weight — more economical pad or pier foundations. Low noise level — ideal for residential areas. Maintenance? Much simpler, with no external dirt-catching tank bracing.

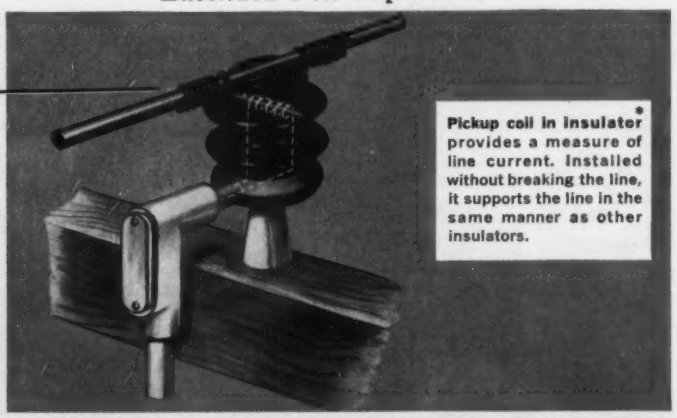
These compact power transformers are available in 7500 kva and below, 69 kv and lower. See your nearby A-C office for details or write **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*

ALLIS-CHALMERS

Extended Foil Capacitors

A-1494





Pickup coil in insulator* provides a measure of line current. Installed without breaking the line, it supports the line in the same manner as other insulators.

Current bias shorting* relay is mounted on the side of the control cabinet in a standard watt-hour meter mount. Its operating point can be easily adjusted from rear of the relay mount.

*Designed by the Fisher-Pierce Company

Slash installation time over 50%

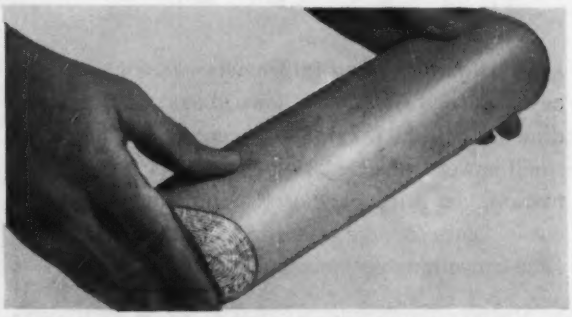
with new voltage-sensitive, current-bias capacitor control

Employing an inductive pickup device rather than a current transformer as the signal source, the new Allis-Chalmers voltage-sensitive current-bias control can be installed *in less than half the time* required for existing controls.

By simply replacing the line insulator with the new pickup insulator, you can eliminate the time and effort of de-energizing, dead-ending and cutting into the line required for a conventional current transformer.

This new A-C capacitor control operates on either light or heavy system loads to switch capacitor banks for voltage correction and reactive kilovar supply.

For more facts on capacitor controls to maintain low-loss, high-power-factor system operation, contact your nearby A-C office. **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin.



Allis-Chalmers extended foil design capacitors withstand higher inrush currents. Current densities are lower at point of contact between the packs and the contact plates than is possible with conventional tab-type capacitor construction.

EEI Unveils Nationwide Interconnection Plan

"It is also hard to understand why in the USA there has been such a weak development of power systems and electric connections between them. . . . It would appear that with such a large generally established electric power capacity existing in the USA the creations of powerful power systems with transmission lines, connecting them with a large transmission capacity, would produce beneficial economic results and considerably raise the reliability of electric supply. Furthermore, it would appear that the time zone difference could be utilized for transmission of electric power from east to west. No doubt these questions are associated with social factors."

—A. P. Rozhdestvenski, Engineer Chief Specialist, USSR Ministry of Power Stations. Nov. 1960

The Edison Electric Institute today unveils the investor-owned electric utilities' vigorous response to such commentary as that reproduced above, which first appeared in the Russian engineering magazine, *Teploenergetika.* The EEI pronouncement (p 42) is perhaps directed more immediately to the vocal advocates of federal power here at home, but it is expressed in terms that should carry the message around the world.

What the investor utilities are saying in very concrete terms is that in less than a decade there will be an integrated national transmission network from coast to coast. By 1970 it is expected that this network will permit all major power systems to operate on an interconnected basis throughout the country. This is not presented as a bold challenge, or a far-away goal, but as a concrete working plan.

The facts, as recorded in the EEI presentation, are that US power systems have for decades worked toward closely coordinated, economic interconnections mainly on a regional basis. These regional groups have frequently reached across boundaries, and tied in with other such pools so that we now have one, the Interconnected Systems Group, that has a combined peak of 64,500 Mw and operates in parallel in portions of 30 states (EW, May 29, p 55).

The noteworthy accomplishment of the EEI task force on future transmission plans has been gathering the data and coordinating the planning of every major utility in the country so that for the first time we have these plans cast in a national setting.

In terms of the amount of generating capacity involved, proposed expenditures, extent of coordination required, these working transmission plans hail tremendous strides for the electrical industry.

It comes at a time of intensifying economic rivalry with the Soviet Union, and will help in comparing actual accomplishments as well as longer range goals.

It also comes at a time of increasing activity upon the part of our federal government to further invade the service responsibilities of investor utilities.

We appraise the EEI pronouncement, and the more detailed plans that are certain to follow, as documents that will put the discourse on interconnections on a much more realistic basis.

Congress Has Mixed Record

Congress is getting ready to adjourn sometime this month with a mixed record on issues affecting the electric power industry. Washington officials and observers feel that, in one respect, the Democratic Congress and Administration have done little to change policies of the last several years. But these same people acknowledge that all important power proposals are alive for another test next year.

Importantly, Congressional opposition stopped, so far, a program to build commercial steam plant capacity at the Atomic Energy Commission's Hanford, Wash., installation. And little progress was made by supporters of big new federal hydroelectric dams in the West.

There is some grumbling among Congressional Democrats that President Kennedy hasn't fought for his power program. They feel that the President has enunciated his program in broad terms, but that he's left most power legislation to fight for itself.

Here's a run-down on major power measures before Congress, just before the 1961 session ends:

● **Hanford Power Facilities**—Legislation to authorize the addition of about 800 Mw of power generation at the Hanford "New Process Reactor" has produced a major, surprising reversal for Pres Kennedy on an issue that most Washington observers originally had assumed would be an easy victory for public power. Two negative votes by the House of Representatives, in the face of Senate approval of the Hanford facilities, laid the foundation for a Senate-House conference. The conference recommended a "compromise" of only 400 Mw of generation at the nuclear plant—all to be used at the AEC's Hanford Works.

The Senate passed the compromise proposal in a form providing $58 million for construction of the 400-Mw plant. Strong House opposition is still expected, however.

Hanford was the keystone this year in Pres Kennedy's power program, and the unexpectedly strong opposition to it brought bitter attacks from public power supporters. Sens Clinton Anderson (D-N.M.) and Lee Metcalf (D-Mont.) and Rep Chet Holifield (D-Calif.) attacked the "private power lobby" in Congress, suggesting, in retaliation, removal of federal subsidies and the AEC's financial assistance, plus cancellation of hydroelectric licenses when their terms expire.

Hanford—until its outcome was settled—also plugged the hole through which other major power measures had to move. The entire AEC authorization bill, of which Hanford was a part, was stalled. And the House Appropriations Committee held up action on the huge Public Works Appropriation Bill, which also included funds to start work on Hanford, until the fight was resolved.

The stalled public works money bill, in turn, blocked final consideration of Upper Colorado transmission line plans until this month. Another stalled power bill, related to the Hanford fight, was for a fuels and energy study recommended by the Senate Interior Committee.

● **Upper Colorado transmission lines**—Pres Kennedy requested about $13 million for fiscal 1962 to start work on an all-federal transmission grid in the Upper Colorado project area. The only hearing held so far in Congress this year on the very controversial plan was a closed session before a subcommittee of the House Public Works Committee. That committee has recommended to Congress that the federal line money be left in the budget, over strenuous opposition of power companies in the area and elsewhere.

A public hearing on the lines will be held Sept. 14 and 15 before a subcommittee of the Senate Appropriations Committee. The first day sets aside a short session to hear federal witnesses, and the second day a longer session is planned to hear objections of the utilities who have proposed an alternate plan.

● **Fuels and Energy Study**—This study, sponsored by Sen Jennings Randolph (D-W.Va.) and 62 other Senators, was stalled in the Senate Interior Committee until the Hanford fight was resolved. Chairman Anderson of the committee reportedly held back on the study (strongly sought by coal interests) in an effort to get coal-state votes for Hanford.

Now, the committee has voted out the study, although in different form from its first conception in Randolph's bill (S. Res. 105). Instead of $200,000 to finance a two-year study of the nation's fuel and energy needs by a special committee—set up on the lines of the defunct

Legislative Scorecard

- **Hanford Power Facilities**—*". . . a major, surprising reversal for Kennedy . . . unexpectedly strong opposition . . . compromise recommended."*
- **Upper Colorado Transmission Lines**—*". . . committee has recommended federal line money be left in budget . . . public hearing Sept. 14-15."*
- **Fuels and Energy Study**—*". . . measure now calls for only $25,000 . . . study would be completed 'at earliest possible date.'"*
- **Water Resources Planning**—*". . . won't win Senate approval this year . . . produced much infighting among Senate Democrats."*
- **Natural Resources Council**—*". . . torpedoed by Kennedy Administration . . . the White House refused to endorse it."*
- **Public Works Appropriations**—*". . . only last week reported out . . . money recommended for various investigations . . . Administration's power planning should appear in next year's budget."*
- **Delaware Compact Commission**—*". . . one small but possibly fatal obstacle . . . preference inclusion may kill plan."*
- **Fryingpan-Arkansas Project**—*". . . snagged in the House Rules Committee . . . been pending before Rules since June."*
- **Burns Creek**—*". . . blocked in House Interior Subcommittee . . . its approval by the House is anybody's guess."*

on Power Issues

AN EAGLE EYE for expenditures characterizes Rep Clarence Cannon (D-Mo.) who heads House Appropriations group. A big budget for federal projects will pass through his hands

Kerr Committee on Water Resources—the measure now calls for only $25,000 (probably more coming next year) for carrying out the studies within the framework of the Interior Committee's own staff. And, of course, the study will be under close scrutiny of chairman Anderson. The study would be completed "at the earliest practicable date."

The study will go into hydroelectric energy as well as coal, oil, gas, and atomic energy. No comparable measure has been introduced in the House.

• **Water Resources Planning**—The Senate Interior Committee has completed hearings on the Kennedy Administration's request for legislation (S-2246) to create: **(1)** a Water Resources Council in the Cabinet, **(2)** various river basin commissions, **(3)** a $5-million, annual—for ten years—federal grant program to states to carry out local water projects. The measure won't win Senate approval this year, however, because—even if the Interior Committee does approve it—the bill will go next to the Senate Public Works Committee for review. This will put Senate study over until 1962.

Also in 1962, the House Public Works and Interior Committees will hold joint hearings on the legislation.

This measure produced much in-fighting among Senate Democrats and Administration leaders on the question of: "Is this bill a substitute for the Natural Resources Council?"

• **Natural Resources Council**—This is the bill (mentioned above) that was torpedoed by the Kennedy Administration. Introduced by Sens Clair Engle (D-Calif.) and Gale McGee (D-Wyo.), it would have set up a freer, more liberal and far-reaching planning unit than the Water Council in the White House. Hearings were held on the legislation earlier this year, but its sponsors were cut short when the White House refused to endorse it. A Senate push on the bill may take place in 1962, but supporters are only now regrouping from this setback.

• **Public Works Appropriations**—The House Appropriations Committee only last week reported out the huge public works money bill for fiscal 1962, already more than two months gone. This includes funds for all the federal government's power activities. One of the intriguing features of the measure is the money recommended for various investigations and studies—much of it for planning of new federal power projects. It is expected that the first fruits of the New Administration's power planning should appear in next year's budget request for public works projects.

In addition to funds for Upper Colorado, the 1962 Public Works Appropriation Bill calls for funds to build a federal transmission tie between the Trinity Project and the Central Valley Power System, Calif. This is identical—but on a smaller scale—to the Upper Colorado plan: a federal construction request in the face of an alternate, wheeling arrangement offered by the nearby utilities. The Trinity lines will be argued in the Sept. 14-15 hearings of the Senate Appropriations Subcommittee at the same time as Upper Colorado lines. Deleted from the 1962 money bill was $216,750,000 for the AEC's plant and acquisition funds, which included the controversial Hanford money. The House left this money out of the appropriation bill because the Hanford battle wasn't settled. The funds will be restored by either the Senate of House later, when the outcome of the question is known.

• **Delaware Compact Commission**—This long-sought compact has come within a hair's breadth of reality in 1961, except for one, small but possibly fatal obstacle—public power preference. The compact has been approved by legislatures and governors of New York, New Jersey, Pennsylvania and Delaware, and by the House of Representatives, without including a preference clause for possible compact power projects (estimated about 400 Mw by the Corps of Engineers).

Interior Secretary Stewart Udall startled the compact's non-partisan supporters this spring by refusing to endorse the federal government's minority role on the Commission (one vote out of five). Recently, he reluctantly agreed to go along with the compact, if six changes were made. Five had to do with federal responsibilities, and the sixth relates to preference. The compact's supporters have accepted the first five but claim the preference inclusion may kill their plan. Not only would the preference amendment send the bill back to the House for re-consideration, but it also might send it clear back to the four state governments. This would be time-consuming, if not fatal, supporters say.

The House of Representatives approved the compact without any of Udall's recommended changes, but apparently it is willing to add the first five. The Senate Public Works Committee has held hearings on the measure but will not vote until the Senate Interior Committee also can consider the measure.

The Public Works Committee is expected to add preference if the Interior Committee does. This will send the bill back for a Senate-House conference, likely delaying approval this year, if not permanently.

• **Fryingpan-Arkansas Project**—This perennial trans-basin reclamation and power project sailed quickly through the House Interior Committee, but promptly got snagged in the House Rules Committee. It's been pending before Rules since June. The Kennedy Administration has supported Fryingpan in a "do or die" manner. Interior Secretary Udall said that if the project couldn't win approval in 1961-62, he wouldn't support it again. The Senate Interior Committee hasn't held hearings on the bill yet.

- Congressional approval necessary for dam for proposed steam plant
- Diversion dam across Savannah River would provide cooling water
- Eventual 2,000-Mw capacity would make plant the nation's largest

Duke Plant Needs Congress OK

Duke Power Co's plans for a 2,000-Mw steam electric generating station on the Savannah River in South Carolina will be dependent upon favorable action by Congress in the next session, according to W. B. McGuire, president of the company.

The utility proposes to build a diversion dam across the river to provide cooling water for the gigantic station—larger than any existing or planned in the nation today—and Congressional approval is necessary for this portion of the project.

Rep William Jennings Bryan Dorn (D—S. C.) introduced the necessary bill (HR—6789), and it is expected to be before the House Public Works Committee early in the next session, McGuire said. Reports from various agencies concerned with the project are generally favorable if certain specifications are met. An identical bill (S-1795) was introduced in the Senate by Sens Strom Thurmond and Olin Johnston, both of South Carolina.

Initial installation in the plant would be two 350-Mw units, but the ultimate capacity would be 2,000-Mw. When the plant is completed, annual cost of operation and maintenance would be $2.5 million (not including fuel), and annual fuel cost would be $26 million. Annual production of electricity would be 10 billion kwhr, and annual coal use would be 3.5 million tons. Ultimate cost of the station would be $280 million.

McGuire said engineering details have not progressed far enough to give steam conditions and other technical data.

The plant is to be located in the area of Middleton Shoals between Clark Hill and Hartwell projects (Anderson County, S. C.) about 297 miles from the mouth of the Savannah River. Duke would like to have the initial installation completed by 1967.

Coordinated With Other Projects

Because of the diversion dam, Duke Power is coordinating its planning with the Corps of Engineers, which wants to build a project at Carter's Island. Also, there is a possibility that pumped storage may be incorporated as a feature of the Hartwell project, and this affects Duke Power's planning. Duke's diversion dam would have to be a few feet higher than for its own needs, and the company has offered to take on this additional $1.3-million expense to make its project compatible with the others.

The company is now completing a 230-kv trunk transmission system throughout its service area, and production of the proposed station would be fed into this system. Present energy requirements of the area are 5.1 billion kwhr per year, and the company expects this to double by 1970. The plant will also support the system of Georgia Power Co through interconnections between the two.

Utility Plan for Upper Colorado Backed

Plans of five investor-owned electric utilities to build part of the transmission lines related to the Colorado River Storage Project have gained the qualified support of the Upper Colorado River Commission.

In a resolution sent to appropriations committees to both houses of Congress, the Commission recommended the utility plan providing the utilities limit their wheeling charges, after the transmission lines have been amortized, to cover only actual *ad valorem* taxes, operation, maintenance, and replacement costs associated with Bureau of Reclamation wheeling contracts.

The resolution was brought to Washington by Ival V. Goslin, chief engineer and secretary of the Commission. Former Sen Ed Johnson of Colorado immediately wrote to members of Congress to tell them of the UCRC's endorsement, and to try to drum up support for the measure as it comes before the Senate Appropriations Committee sometime this week.

Peace River Project Moves Ahead

The recently-nationalized British Columbia Electric Co (EW, Aug. 14, p 64) is going ahead with development of the Peace River project as promised by Premier W. A. C. Bennett when he expropriated the utility. Dr Gordon Shrum, whom Bennett named to head the company, has announced that a contract for a work tunnel will be placed this month.

The tunnel will ultimately form one of the three diversion tunnels, which are expected to cost $18 million. The British Columbia highway department has started an access road to the proposed Portage Mountain damsite near Hudson's Hope in north-central British Columbia.

Controversy over the nationalization still exists, although it is now more subdued than immediately after the takeover. Premier Bennett told a press conference that his move had forestalled a proposed boost in power rates. The former executives of B. C. Electric have denied the charge vigorously. Bennett has hinted that he will cut rates just prior to the next election.

USSR Nuclear Program Moves Ahead Slowly

Fast-neutron breeder reactor development seems to be lagging in Russia, according to a recent writing by G. Ermakov, official of the Ministry for Power Station Construction. "Almost all" reactors built or under construction use slow neutrons, he reported and added that fast-neutron reactors are not studied enough yet.

Thermal-neutron reactors are already developed quite well, says Ermakov, "but specialists differ in opinions about which is the most promising type." He offered an opinion, apparently tied at least partly to British and American experience, that gas cooling is best for natural-uranium reactors and light water for those with slightly enriched fuel. He called for improvement of existing reactor types and continued development of new types. Ermakov added that research has narrowed the list of possible combinations of fuels, coolants and moderators from 200 to 10.

Vasili Yemelyanov, chairman of the State Committee for Atomic Energy, gave in an Izvestia article a general outline of the Soviet Union's atomic energy program. "We have different installations," Yemelyanov wrote, "using as coolant water, organic liquid and molten metals. Different moderators include light water, heavy water and graphite." He said that "among nuclear power units being built" are two large atomic power stations in the Soviet Union: a 100-Mw graphite - moderated, pressurized - water reactor at Beloyarsk (EW, Aug. 28, p 61) and Voronezh atomic power station where two boiling-water reactor units will have a capacity of 210 gross Mw each. The Soviet press has not recently mentioned any other large power reactors under construction in the Soviet Union.

Yemelyanov said that the Soviet Union is helping to build a 150-gross-Mw plant in Czechoslovakia with heavy-water moderating and CO_2 cooling and a 70-Mw BWR in East Germany. These four Russian and satellite stations had been reported before. The Communists have reported startup of two stations, one each at 5 and 100 Mw.

Yemelyanov continued, "We are sure the problem of the practical utilization of controlled thermonuclear processes will be solved by our scientists." Noting that such research necessitates the creation of near total vacuum and strong magnetic fields, he reported great progress here. Several types of experimental units are under construction.

The discovery of antiprotons and antineutrons in recent years, he stated, point to another possible way of obtaining nuclear energy—annihilation of particles. In combining protons and antiprotons, it has been found that the mass of the particles passes into radiation. Such a process yields output of energy some thousands times greater than under thermonuclear synthesis.

Germans May Order Power Reactor

Bonn (McGraw - Hill World News)—There are definite possibilities that Rheinisch-Westfaelisches Elektrizitaetswerk (RWE) will order a 240 or 300-Mw reactor next spring. It would be the first power reactor of commercial size to be built in Germany.

If all goes well, the reactor could be completed by late 1965 or early 1966. RWE's evaluation of offers, originally planned to be put up for discussion this summer, is now expected to be completed in late fall. Indications are that RWE is no longer speculating over merits but is seriously inclined to go ahead with the project.

One offer is from a consortium of General Electric and Allgemeine Elektricitaets-Gesellschaft (AEG) for a 302-Mw, boiling-water, graphite-moderated reactor with internal steam separation and forced circulation. The other is from a consortium of English Electric and Siemens for a 237-Mw gas cooled and moderated reactor. In both cases the German partner of the consortium would supply the majority share of the total order, while the American or British partner would supply the reactor. It is believed, though, that the German firms would like to supply at least parts of the reactors under license.

Planned location for the reactor is the Danube area between Ulm and Regensburg. RWE has repeatedly stated that it will build a power reactor only if and when costs are competitive with conventional power generation. With heavy freight charges from the Ruhr to Bavaria, nuclear power generation costs are now calculated at the same level with hard-coal produced power in Bavaria.

Pennsylvania Weighs Coal Pipeline Bill

A bill authorizing the formation of corporations for the purpose of building coal pipelines, and granting the corporations the right of eminent domain, is currently stalled in Pennsylvania's Senate State Government Committee. It passed the House by a vote of 110 to 94.

Coal interests in southwestern Pennsylvania bituminous regions are reportedly urging Senate action, but railroad interests are opposing it. Political observers do not expect action on the bill in the Senate, where a 25-25 split in membership gives the expected Republican opposition a veto power.

The proposed pipeline would carry coal slurry, which is a mixture of coal and water of a consistency that can be piped. Any planned pipeline would probably originate in southwestern Pennsylvania and terminate in eastern Pennsylvania, New Jersey or the New York area.

In opposing the pipeline bill in the House, Republican minority leader A. W. Johnson said it would be unconstitutional if coal mine interests also attempted to transport coal. Democratic majority leader Stephen McCann hailed the proposal as a boon for southwestern Pennsylvania.

1 **BILLING** begins with punching of current meter data into 'advance' gas and electricity billing cards

2 **IBM** 604 figures usage in current month; finds variance between months, net and gross amounts due

3 **BILLING DECK** is sorted into gas, residential electricity, and commercial electric customers

By-Product Benefits

Punched card billing with IBM equipment cuts per-customer cost, gives San Antonio PS data for system reinforcement

A. L. SCHWARZ, Assistant Treasurer, Manager of Customer Accounting, City Public Service Board, San Antonio, Texas

Punched-card billing is a boon to all utility operations of the San Antonio City Public Service Board. Two years after installation of IBM equipment, accounting costs were an enviable $4.44 per customer—this for a company whose total electrical expenses, less generation, were $24.20 a customer.

Besides much lower customer accounting costs, benefits of the new bill processing include ready data for improving distribution, operational, and rate planning. These are all vital to a company in an area of booming residential and industrial expansion.

Give Growth Pattern

Routine bill processing daily captures bill frequency and revenue data on the punch cards. This information, gathered into daily, weekly, and monthly reports, pinpoints and gauges the growth pattern of electric loads. It does the same for gas distribution. The reports, used by top management, distribution engineers, and rate analysts, leave little room for error in making provisions for future needs.

Formerly, such figures and use-classification breakdowns were assembled manually, but only in part and after long, tedious hours. Since 1947, when the first IBM equipment was put to use, the customer accounting department has absorbed more than 100% increase in workload, while enlarging its staff 20%.

105 Workers Not Needed

In 1950, the board served 115,000 electrical connections and 88,000 gas tie-ins. There were 161 employees in the customer accounting department. Over ten years, electrical connections became 190,000 and gas 160,000. But there are today only 217 customer accounting employees. Without mechanized billing, the department would need at least 105 more people just to get the bills out.

The by-product revenue and bill frequency reports were added to the department's accomplishments without investment in specialized equipment. Most of the computing is done by one of two IBM 604 electronic calculators, which also figures each customer's net and gross bill. Checks on the calculators also determine whether there is a large variation between the bills for consecutive months, and the calculator gives the fuel cost adjustment as part of the analysis of electrical accounts.

Bills in 22 Cycles

Billing is accomplished in 22 cycles, a complete district being billed each cycle. Normally, the board bills a cycle a day, running an average of 8,500 bills daily. The bills are usually in the mail on the fifth day after a customer's meter is read, ten or 11 days before the discount deadline.

"Advance" billing cards are punched for each customer as part of the routine. These contain identifying data and rate coding. Only the current reading and date, amounts of gas and electricity used during the current period, net and gross amounts due, and demand, if applicable, are punched in advance.

As each billing cycle arrives, the advance customer cards are removed from a file in the same order as reading sheets in route books. Card-punch operators average 600 to 800 cards an hour, punching the current reading data from route books to the cards.

Each customer has a separate card for gas and electricity. His name is pre-punched into the gas card and his address into the electrical billing card. Separate name and address cards are kept for customers who have more than a two-line address. An IBM 88 collator

Augment Mechanized Billing Payoff

merges these in proper position with the billing cards before bills are printed.

In the first run, the calculator subtracts previous-month meter readings from the present ones and punches in the current-month consumption. In doing this, it checks the current reading against the previous one to ascertain that the variance between the two does not exceed 60%. When the difference exceeds 60%, the 604 separates the card for manual checking.

After figuring consumption, the calculator applies the rate—as indicated by the card's coding—and automatically figures the gross and net amount due from the customer. It punches these amounts into the card. Cards are then sorted by IBM 83 sorters into three groups—gas sales, residential electricity sales, and commercial and industrial sales.

Within these classifications, the cards are further sorted by consumption amounts or levels. All customers using 0 to 1,000 cu ft of gas are in one group, those using 1,000 to 2,000 cu ft in another, those using 9,000 to 10,000 cu ft into a third, and so on. A similar procedure is followed for electrical consumption.

Sorting completed, the cards are run through an IBM 528 accumulating reproducer. This counts the cards in each consumption class, adds total amounts, and punches summary cards for each consumption classification. The latter cards contain the number of customers into each consumption classification, total usage, and the total revenue for each class.

Operators feed into the 528 an average of 16,000 to 18,000 cards a day and come out with the data reduced to 1,800 to 2,000 summary cards. The latter are the basis for revenue reports and bill frequency analyses.

Bills Printed

After summarization, the original billing cards are sorted again into account number order. Name and address cards for those customers having an address requiring more than two lines are merged by the IBM 88 collator into the billing group. The next month billing advance cards are reproduced by a 514 reproducing punch. Pre-punched arrears cards and cards representing other transactions are now sorted into the deck by account number, and the bill writing begins.

Two IBM 402 accounting machines, one with dual carriage, print the bills. Reading from gas, electric, and special address punched cards, the first 402 addresses the postcard bill form.

Run Revenue Report

This continuous bill form set overlap a billing register form on the machine's platen. After addressing each bill, the accounting machine's carriage moves over and current billing information is printed on the register. When the register balances at the end of this run, the continuous postcard bill forms are turned over and run through the second 402. Usage and money-due information is printed on each customer's bill, and the bills are burst and released.

While billing proceeds, the department sorts the 1,800 bill frequency analysis summary cards by town code and revenue class. These are fed into an IBM 407 accounting machine which runs a daily revenue report. At the same time, a summary punch linked to the accounting machines cuts new summary cards by town and class. These contain only totals and are held until the end of the month when all-inclusive reports are run by these classifications. They also become the input for a 604 and calculate fuel and tax adjustments.

The month-end result is a graphic accumulation of gas and electrical distribution and revenue data in a single report form showing how much of each was sold to each town or class of users, applicable adjustments, how many bills were cut for that town or class, and usage in consumption classifications, complete with net and gross dollar amounts. Monthly summary cards are filed and used to produce periodic reports on the pattern.

The by-product reports have proved invaluable in day-to-day operation, in rate studies, and in planning present and future distribution needs. They are bonus payoffs over and above the primary benefits of mechanical billing.

4 **SPECIAL** name and address cards are merged into the billing deck by IBM collator before printing

5 **BILLING** is accomplished on two 402 accounting machines

$8-Billion Transmission Plan Unveiled

Investor-owned utilities reveal plans for complete, coordinated, high-voltage interconnection of systems over next ten years

Complete interconnection of the nation's investor-owned power systems in the next ten years is foreseen in a coordinated program for expanding the high-voltage transmission lines and facilities of the nation's electric utility companies.

To build these new transmission lines, US electric companies expect to spend a total of about $8 billion through 1970. This would more than double the industry's investment in transmission facilities, presently about $6.7 billion. Thus, allowing for replacement of equipment, the companies total investment in transmission facilities would reach approximately $14 billion in 1970.

Details of the electric companies' transmission expansion program were disclosed in New York this week by Philip A. Fleger, president of the Edison Electric Institute and chairman of the Duquesne Light Co.

Specific information on the miles of lines to be built by the power companies is not available. However, informed observers estimate that upwards of 100,000 miles of line of all voltages will be built under the program and would permit all major power companies of the US to operate on an interconnected basis.

A map showing the projected lines to be built between now and 1970 is shown on the accompanying insert.

Advantages of Interconnection Listed

The ten-year transmission expansion plan proposed by the electric companies would have the following advantages:

- Link the 136 million kw of new generating capacity, expected by 1970, to load centers in the most economical and efficient means
- Permit electric companies to continue today's trend to larger, more-efficient generating units
- Expand the number, and scope of today's power pools and interconnections
- Conserve industry reserve generating capacity through the exchange of economy and emergency energy among systems with different load characteristics.

Many of the future lines shown on the map will be constructed to operate at 345 kv. However, some of these will be built for conversion later to 500-kv operation. Still others will be at 230 kv and 115 kv, depending on needs of the systems involved. No attempt has been made in mapping the lines to show operating voltage.

The transmission plan is the product of a two-year study by an EEI task force of transmission experts in which the transmission plans of individual electric companies for the next ten years were coordinated with those of neighboring companies on a region-by-region basis. Work of the EEI Transmission Task Force in making the study was described by Charles E. Oakes, chairman of EEI's Committee on Power Capacity and Pooling and chairman of the board of Pennsylvania's Power & Light Co. A similar task force under Oakes direction last year compiled a study of power loads and capacity needs of US electric companies showing that in 1970 peak loads will reach 226.5 Mw . . . about double existing loads today.

Bulk of the new transmission lines to be built under the expansion plan will be financed by investor-owned electric companies. However, a few lines have already been authorized and will be built by federal government agencies.

Expansion of electric company transmission systems goes hand-in-hand with the growth of power pools and interconnections which has marked the evolution of electric company system operations for two decades or more.

Today nearly all the electric systems east of the Rocky Mountains, including 100 companies in 32 states, are now interconnected. West of the Rockies, interconnected operation has been a fact for several years, both in the Pacific Northwest and the Pacific Southwest.

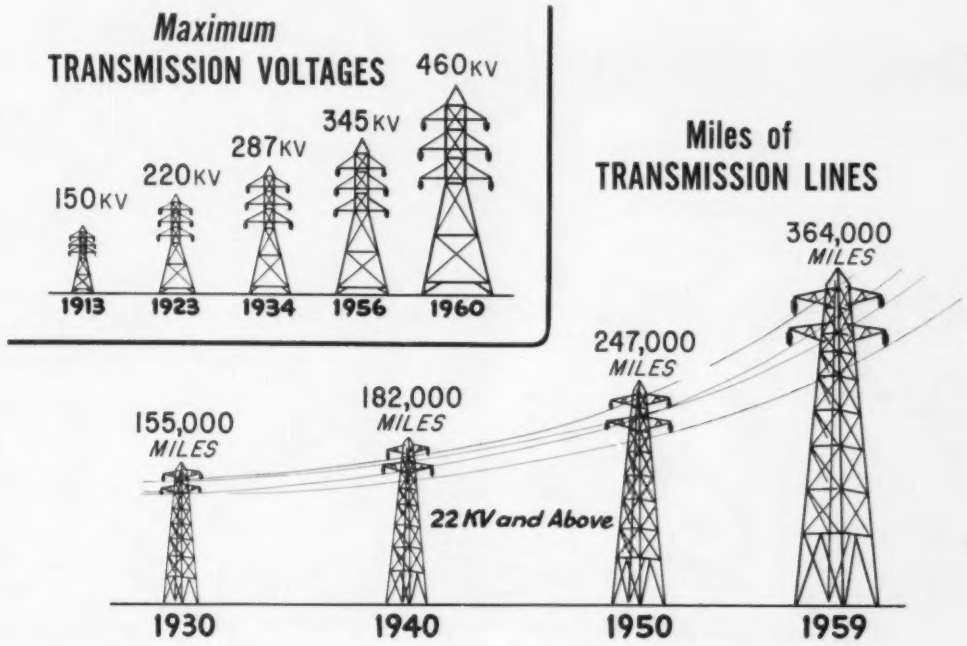
Many Interconnections Exist Already

At present, virtually 85% of electric utility generating capacity in the US is part of one or more interconnected system groups. Upwards of 20 such groups, some operating as formal power pools, now exist tying together an aggregate generating capacity in excess of 150 million kw (EW, Nov. 9, 1959, p 54-55). Among recent examples of this continuing trend are these:

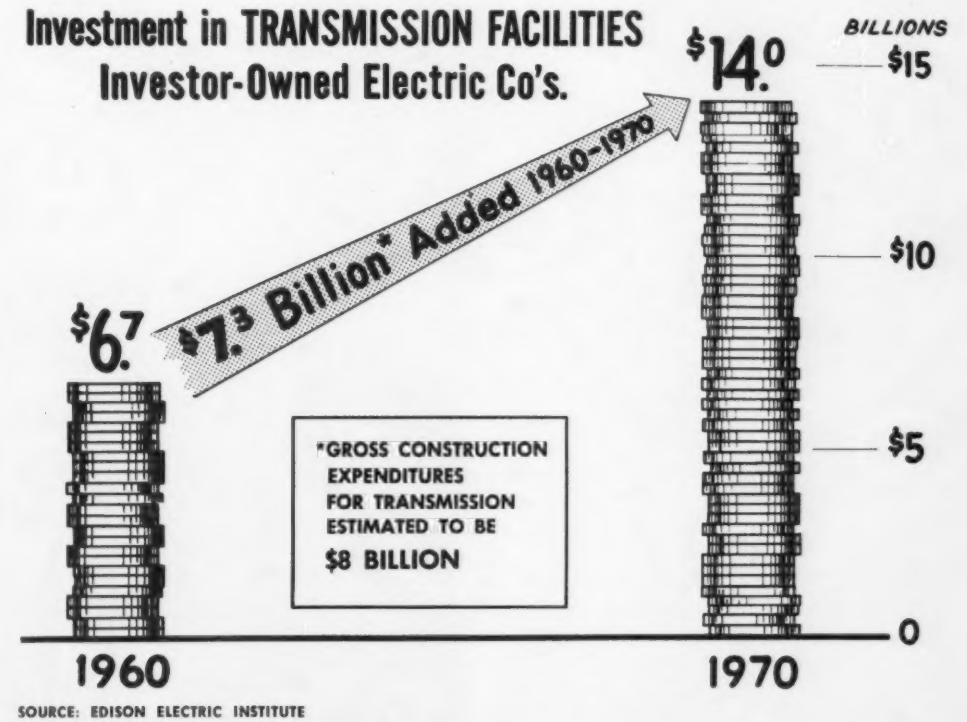
- In April a group of electric companies in eight Midwest and Southwest states announced plans for building a super power grid involving at least 4,000 miles of 345-kv and 230-kv lines at an estimated cost of $300 million.
- This June, Minnesota Power & Light Co and two other Midwest utilities announced plans for four major high-voltage interconnections that would cost more than $3.1 million.
- Four investor-owned utilities and a cooperative system in the Midwest have recently created a power pool called the "Upper Mississippi Valley Power Pool" to provide more efficient and economical operation of each participant.
- In southeastern New York State this spring a formal four-company pool was created comprising Consolidated Edison Co and three contiguous companies which will link 7 million kw of generating capacity.

Spending Rate Will Be Stepped Up

Currently the approximately 400 investor-owned electric companies in the US have been spending at the rate of $3.2 billion annually for new plant and equipment. By 1970 when the $8-billion transmission expansion program is to be completed, the industry's peak load will be approximately 226.5 Mw and expenditures for new construction will be at the rate of $6.4 billion annually. By 1980 when system peaks are expected to reach about 428.5 Mw, annual expenditures by electric utility companies are expected to reach $12 billion a year.



SOURCE: EDISON ELECTRIC INSTITUTE



SOURCE: EDISON ELECTRIC INSTITUTE

PRINCIPAL INTERCONNECTED ELECTRIC

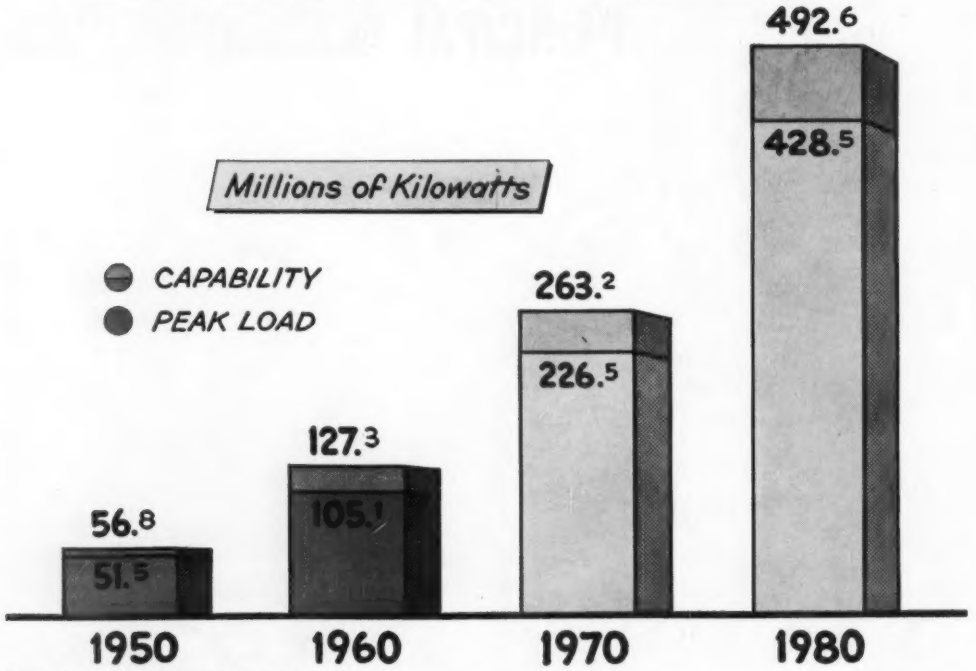
Lines expected to be built by 1970 a

TRANSMISSION LINES

are shown in red

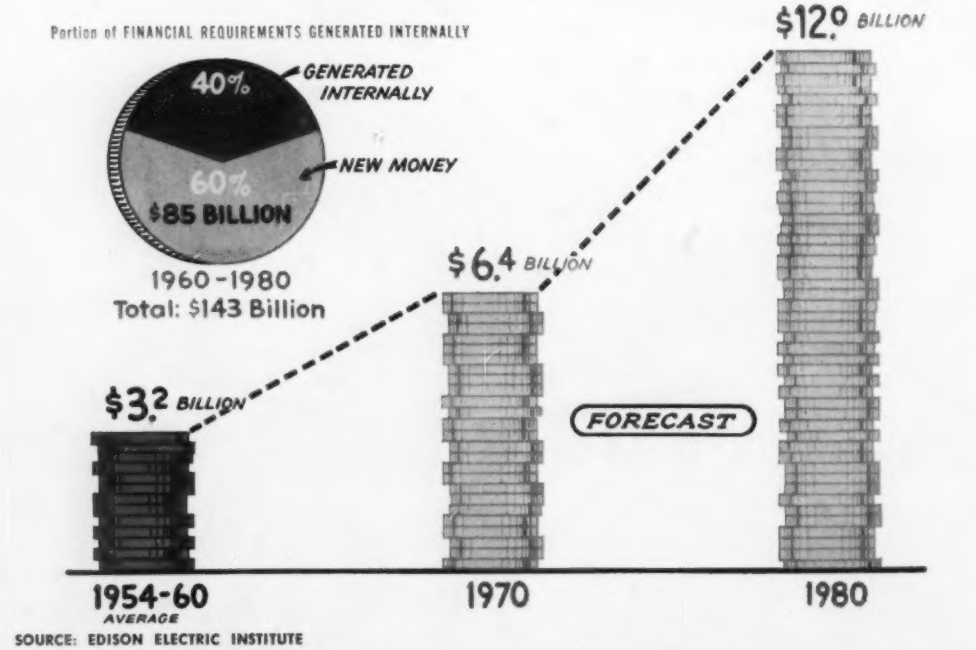
SOURCE: EDISON ELECTRIC INSTITUTE

Electric Company CAPABILITY AND PEAK LOAD



SOURCE: EDISON ELECTRIC INSTITUTE

CONSTRUCTION EXPENDITURES · Investor-Owned Electric Co's.



SOURCE: EDISON ELECTRIC INSTITUTE

This month in Europe . . .

French Nuclear Plants Taking Shape

Paris (McGraw-Hill World News) —There is progress a-plenty to report at mid-1961 on the 1,000-odd Mw of nuclear capacity under construction or close to startup in France.

At Chinon, the Loire Valley site where the state-owned utility, Electricité de France (EDF), has three reactors underway, EDF-1's steel pressure vessel now is welded and hydrostatic tests at one-and-a-half times the 335-psi operating pressure are in progress. (The initials of the utility have been adopted as reactor designations at Chinon.) EDF, quite frankly buying nuclear know-how as well as kilowatts with its investment in Chinon, learned the hard way how to weld the 4.2-in.-thick steel plates that make up the 33-ft-dia, 75-ft-high vessel. During the first attempt, a long crack opened up alongside a weld after the vessel was half finished. EDF had to dismantle it and start welding from the beginning with a more elaborate technique. In essence, for the second, successful attempt, EDF stacked up the rings that make up the cylindrical vessel, insulated them, heated the preassembled rings and then made the welds. That way, cooling of the plates could be closely controlled to hold residual stresses well within acceptable limits.

With the pressure vessel welded, EDF now expects this first Chinon reactor to go critical in late summer, 1962. Apart from the reactor itself, EDF-1 unit is practically finished. The 82-Mw generator, for example, has already produced some kwhr on steam from an auxiliary boiler. The critical component in the gas-cooling circuit, the main blower, ran during full-speed tests without a murmur, EDF reports. All three Chinon reactors are CO_2-cooled, graphite-moderated and fueled with natural uranium.

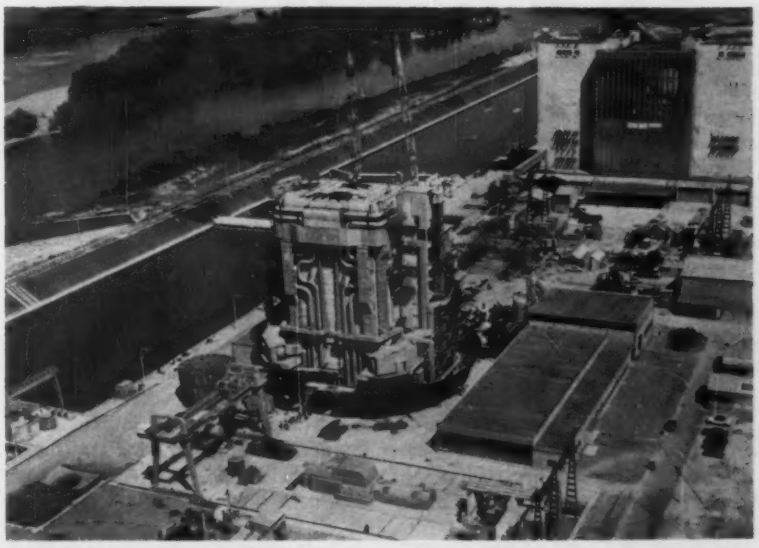
EDF-2, one of whose two 125-Mw generators is already installed, trails the first unit by a year. With EDF's painfully acquired welding knowhow and the thinner (3¾ in.) plates for the 60-ft EDF-2 spherical pressure vessel, no welding difficulties are in sight. In fact, the lower half of the sphere is welded already and no troubles have developed. Other parts of the plant are well along. Of the four heat exchangers, each in a massive concrete tower, one is finished, two nearly finished, the fourth well underway. EDF expects to wind up work on them before the year is out.

Last of the three units at this site is now scheduled to go on the line in late 1965 and will bring Chinon to 832 gross Mw of generator capacity. EDF-3's nominal rating is 375 net Mw but like all the Chinon reactors it is conservatively rated. (Nominal ratings for EDF-1 and 2 are 60 and 170 net Mw.) The two 250-Mw generators slated for this third unit are a tipoff to what EDF expects the reactor will be able to do with the second and subsequent fuel loadings. For EDF-3, EDF opted for a prestressed concrete pressure vessel strictly because of cost and not because of the EDF-1 welding setback, say executives of the utility.

Along with its Chinon complex of gas-cooled reactors, Electricité de France has its hand in two other reactor projects, both tentatively slated to see construction starts before the end of the year. Equal partner with a Belgian utilities group in Société d'Energie Nucléaire Franco-Belge des Ardennes (SENA), EDF will learn about pressurized-water techniques with a 242-Mw plant at Chooz near the Belgian border.

Last of the major obstacles for this reactor crumbled when Euratom recently granted $8-million aid to the project. (France voted against the grant, which was part of a $32-million aid package for several Euratom plants, because the French felt that aid should go for research, not power plants.) Even though some details have to be cleaned up before the letter of intent sent to the Westinghouse - Framatome - ACEC group is turned into a firm contract, SENA has issued invitations to bid on the civil engineering work and has started on access road. Work should start toward the end of the year and the reactor should be ready near the end of 1965.

Work should start, too, toward the end of the year on the 80-Mw gas-cooled, heavy water moderated reactor, EL-4, that Commissariat à l'Energie Atomique (CEA) has scheduled for 1965 completion in Brittany. EDF is handling the heat exchangers and power generating equipment for this CEA reactor. EL-4 will have an unusual feature in beryllium cladding, which is not now planned for any US power reactor.



CHINON'S EDF-1 and 2 generators are rated 332 Mw though nominal plant ratings total 230 Mw. Dish below EDF-1 (front) is part of containment sphere

Paradise Plant Designed for

TVA to put in first 650-Mw units; steam sub-critical and heat rate 8,775 Btu per kwhr; unit in service in September 1962

REED A. ELLIOTT, Chief Water Control Planning Engineer,
WALTER F. EMMONS, Chief Design Engineer,
HENRY T. LOFFT, Chief Construction Engineer, Tennessee Valley Authority, Knoxville, Tenn.

Two 650-Mw cross-compound units, the largest to date, will be installed in the Tennessee Valley Authority's Paradise Steam Plant. Their cost will be $182 million, $130 per kw based on expected continuous capacity.

Each unit is rated 325 Mw, 361,-111 kva, 90% pf at 32-psi hydrogen pressure, 24 kv, 3-phase, 60 cps. The first will go into service in September 1962; the second in July 1963. Plans call for two later units of equal or larger size.

Units of such size are justified at Paradise by the TVA system's present 11,885 Mw of generating capacity, which could become even larger through today's system-planning practices. The first unit will represent only about 4% of the system capacity when it is scheduled to go into service.

Plant Is Enclosed

Paradise will be a totally enclosed plant with building space of 15 cu ft per kw. Its Wayne County, Tenn., site was picked by the usual process of elimination based on comparative costs—in this case, only two sites being considered. One was on the Tennessee River near the Kentucky Dam, in northwestern Kentucky, at a place called Hickory Point. The other, that selected, was on the Green River, near the village of Paradise, Tenn.

The Hickory Point site has unlimited water supply, good transportation facilities, good terrain. But coal handling involved distances greater than those at Paradise, and foundation conditions would require an expensive substructure.

The Paradise site has fuel, a fair supply of water, good transportation, and is suitable from the standpoint of transmission tie-in with the system and proximity to heavy load centers. The terrain, however, presents problems. River stages range up to 55 ft above the normal pool level of Green River Dam No. 2.

A detailed comparison of the two sites was made for installation of one unit and possible future installations of two, three, and four. For each addition the plant investment was greater at Paradise by about $1 million to nearly $3 million. Yet, when the estimated savings in fuel costs were included, the comparisons showed advantages at the Paradise site ranging from more than $1 million to nearly $5 million, annually. Transmission costs also favored it.

Coal Reserves Nearby

Discharge of the Green River at the plant site varies from 500 to about 205,000 cfs. Planned upstream flood control reservoirs will give some low-flow regulation. Cooling water supply should be adequate for two units. Artificial cooling facilities may be justified when other units are installed.

Large reserves of strippable coal, available adjacent to the site, it has been estimated, will average slightly under 11,000 Btu per lb and be delivered at a cost less than 14¢ per million Btu.

Besides the unusual unit size, the Paradise design has these features:

1. Stored-program data-processing computing equipment with a general-purpose digital computer for performance calculation, partial automation and monitoring, and expandable for complete plant automation.

2. Flash evaporator for make-up and potable water supply will use raw river water, eliminating the primary water-treatment plants at an approximate saving of $1.6 million.

3. An underwater diversion dam downstream from the intake and a combined skimmer wall and trash boom will operate in the intake channel.

4. Cyclone-fired boilers, tubular air preheaters, and compressed-air soot blowing.

5. Coal-handling-system innovations for receipt of run-of-mine strip coal, designed to accommodate pieces as large as 18 by 30 in. by 5 ft.

6. Service and office bay and turbine erection area in the center of an ultimate four-unit plant.

7. Four-unit electrical control wing next to the turbine erection area. Two mechanical unit control rooms are in the bunker bay between boilers for the four-unit plant.

8. No gantry crane for servicing pumps and traveling screens at the pumping station. A mobile yard crane will be used.

9. Station service will be at 6,900 v for most of the larger rated motors and 480 v for smaller ones.

The plant axis is perpendicular to the river, the first two units next to the river and future units on the land side of the central service and office bay. This arrangement will permit outgoing transmission lines to be built along the river, minimizing interference with the surrounding coal-stripping operations.

Coal, delivered by the supplier to two ground-level receiving hoppers, will be conveyed to the breakers. After elimination of rejects, the coal will be weighed by two in-series belt scales on each of two conveyors. Coal payment will be made from the scales' readings.

How Water Circulates

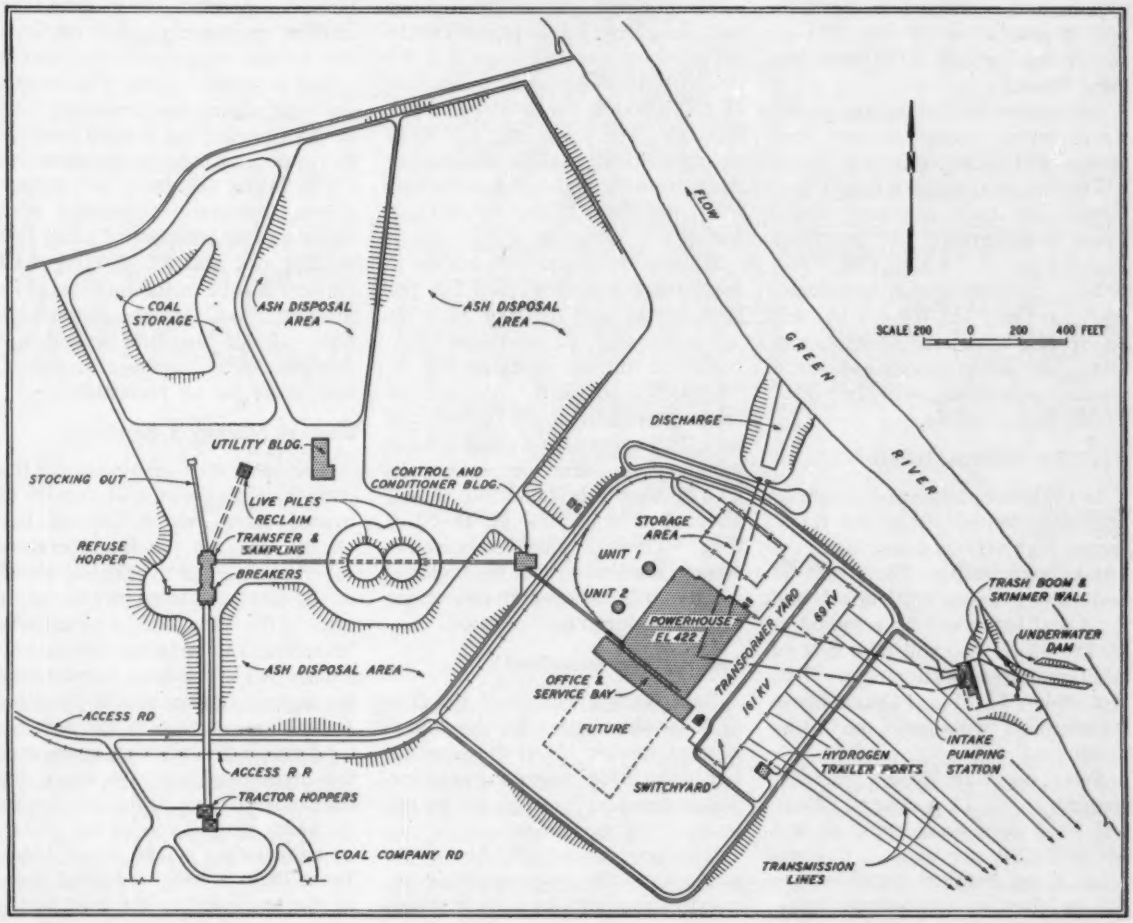
All coal-handling equipment will be controlled from the control center in the conditioner building on week days and from the powerhouse unit control room on week ends.

The intake pumping station will be at the end of a short intake channel from the river. A submerged dam and skimmer wall will act as a trash stop at normal river levels, and a floating boom will provide trash protection at higher levels.

An underwater dam will assist in diverting the cooler bottom water into the intake channel and will reduce any recirculation of condenser discharge water. The skimmer wall will also assist in obtaining the cooler bottom water during low flow.

Turbogenerator shafts will parallel the longitudinal axis of the plant to reduce the turbine room crane span and save space. The

1,300 Mw in First Two Units



AXIS of Paradise Plant will be perpendicular to Green River. Each unit will have its own intake and discharge tunnel. The plant's office and service bay will be in the center of the ultimate plant consisting of four units

electrical control wing for four units will be in the center of the ultimate plant.

The plant is designed on the unit system, one boiler per turbine and no cross connections between boilers. Boilers are arranged for downdraft design with tubular-type air preheaters.

Turbine-generators will be 3,600/1,800 rpm, cross-compound, four-flow units, for operations at 2,400 psi, 1,050F, with reheat to 1,000F, with eight stages of feedwater heating. Guaranteed nameplate rating of each unit is 650 Mw at 3-in. Hg back pressure and 3% makeup. Expected continuous capability at 1½-in. Hg back pressure and no makeup is 700 Mw. With the top feedwater heater bypassed, a short-term peaking capacity of 740 Mw is expected.

The 3,600-rpm primary shaft will have a single-flow, high-pressure turbine, double-flow intermediate-pressure turbine, and a generator with direct-connected exciter. The 1,800-rpm secondary shaft will have two double-flow, low-pressure turbines with 38-in. last stage blades and a generator with a direct-connected exciter.

Main steam from the boiler at 2,400 psi, 1,050F will be supplied to the high-pressure turbine through three stop and four control valves. Maximum steam flow through the high-pressure turbine, with all control valves wide open, will be 4,845,000 lb per hr. Exhaust steam from the high-pressure turbine at 512 psi, 655.3F, will be reheated and returned to the intermediate-pressure turbine through two combination stop-interceptor valves at 459.3 psi, 1,000F.

Stator windings will be direct-cooled by water. The rotor and stator core will be hydrogen cooled. Each main exciter will be direct-gear-driven from the generator shaft. Exciter field excitation will be by an amplidyne motor-generator set.

Generator connections follow the unit system. Each 24-kv, 10,000-amp generator bus of the cross-compound unit will connect to the low-voltage terminals of a 3-phase, 375-Mva, step-up power transformer, without switching. A unit station

service transformer will be tapped off each generator bus outdoors. The two power transformers for each unit will be paralleled on the 161-kv side and connected to the main and transfer bus of the 161-kv switchyard through 3,000-amp gas (SF_6) breakers.

All station auxiliaries, except the steam-driven main boiler feed pumps, will be motor-driven. There will be one unit station service transformer for each generator shaft. These transformers will be rated 22.5-6.9 kv, 18/24 Mva, OA/Fa.

Two common station transformers, each rated 161-6.9-6.9 kv, will be supplied from a different bus section of the 161-kv switchyard. Each secondary winding will be rated 27/45 Mva, OA/Fa.

Has Two Voltage Levels

In the transformer yard, overhead lines will connect from the transformer high-voltage terminals to the 161-kv switchyard. There will be two voltage levels for Units 1 and 2. Local loads will be supplied at 69 kv, which also will take care of additional area development. Two 161-69-kv, 70-Mva, FOA, 3-phase transformers will serve the 69-kv switchyard.

Seven outgoing 161-kv lines will transmit to the TVA system. These will have twin conductors of 954 MCM ACSR per phase. If Units 3 and 4 are installed, consideration will be given to high-voltage transmission with one transmission line per unit.

Steam generators will have a single pressurized furnace with two division walls. Of the once-through design they will be cyclone fired, slag-tap type. Rated continuous outlet capacity will be 4,900,000 lb per hr of superheated steam at 2,450 psi, 1,053F, and reheater steam flow of 3,480,000 lb per hr at 474.5 psi, 1,003F. The feedwater will enter the economizer at 533.4F. Return steam from the high-pressure turbine will enter the reheater at 500 psi, 656.4F.

At rated load, the heat release in the furnace will be 17,670 Btu per cu ft per hr, and the heat available in water and steam-cooled, flat-projected furnace envelope will be 76,000 Btu per sq ft. Average gas temperature leaving the furnace will be 2,250F. Furnace walls will be of membrane construction. The walls will be shop fabricated into panels about 8 ft wide and up to 61 ft long. Through this construction adds to the first cost of the boiler, it results in a substantial net saving through reduced field erection.

Superheaters Described

Superheaters will be of the continuous-tube type, the horizontal primary section above the economizer in the birdcage and the pendant-platen secondary section at the entrance from the furnace.

The economizer will be of the continuous-tube type separately encased. The reheater will be pendant-continuous-tube type and will be in the furnace outlet. The air preheater will be the tubular type in three sections.

Each steam generator will have 14 10-ft dia, radial-type, cyclone burners complete with drag-type feeders, gas burners, and oil ignition torches with remote pneumatic lighter controls. There will be two gas recirculating and tempering fans for each boiler, to control furnace absorption and reheat temperature.

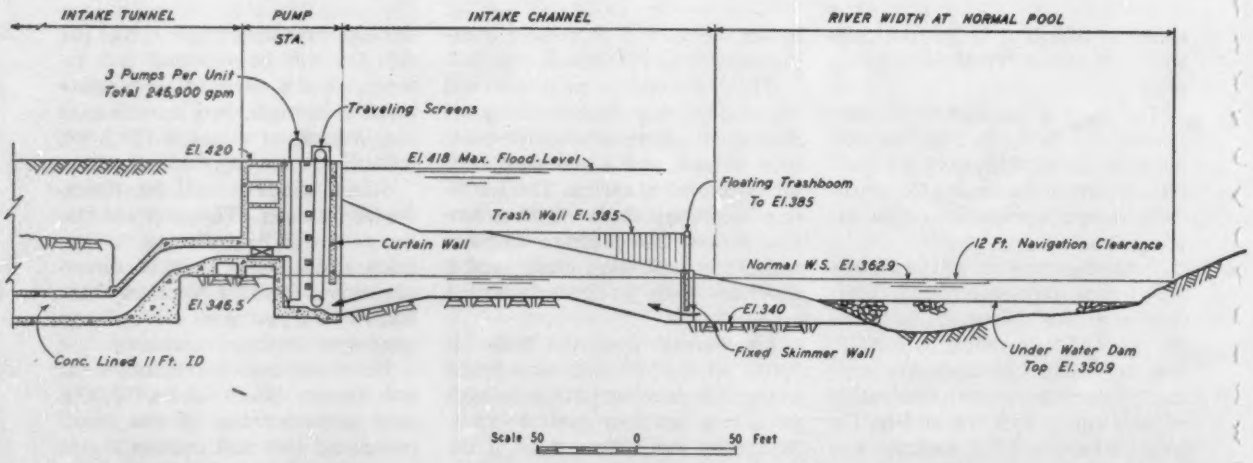
The boiler will have 149 motor-driven, automatic sequential soot blowers using compressed air at 200 to 250 psi, and 85 rotating wall blowers will be in the furnace. The remainder will be the retractable type, 42 for the superheater and reheater, eight for the economizer, and 14 for the air preheater.

Normal Startup 3 hr

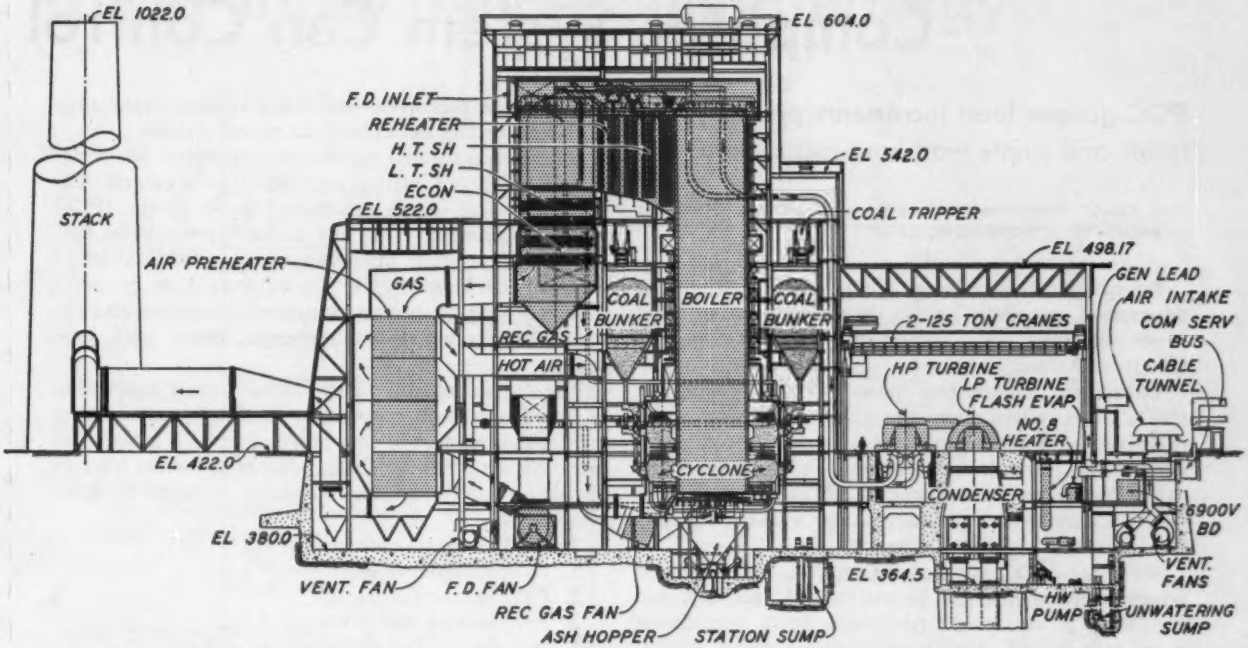
The basic start-up system for the once-through boiler will consist of bypass valves and a take-off line ahead of the high-temperature superheater and a bypass line ahead of the turbine through which all or some of the water and/or steam may be reduced in pressure and led to a flash tank. The total elapsed time for normal startup should be 3 hr.

Building ventilation air will enter through the basement, pass over the equipment, and up along the sides of the boilers, where it will pick up heat. At the top of the boiler, its temperature will be about 120F. From there it will be ducted down to the basement to the inlet boxes of the forced draft fans.

The forced-draft fans will be



UNDERWATER DAM and skimmer wall in the intake channel will divert cooler bottom water to the condenser. Planned upstream flood control reservoirs will give some low-flow regulation. Artificial cooling is considered for future units



UNIT DESIGN is followed, each turbine-generator having one steam generator, and there is no cross connection between the boilers. The latter are arranged for down-draft design with tubular-type air preheaters

driven by 5,500-hp motors through variable-speed, fluid drives. Variable-speed control was selected over inlet-vane control, because of some evaluated saving at rated load, substantial power saving at lower loads, and saving possible in motors because of lower starting torque required.

With cyclone-firing of the boiler, it is estimated that approximately 80% of the total ash will be tapped from the bottom of the furnace as slag and the remainder will go to the stack as fly ash. The stacks will be 600 ft high, higher than any TVA has used.

Slag from each boiler will be tapped into two slag accumulation tanks below the furnace, from whence it will be removed by an hydraulic jetting system.

Fly ash will be accumulated in hoppers under the air preheaters, the economizer, and in the bases of the stacks. From these points, it will be transported dry through a piping system by means of vacuum-producing, hydraulically operated, jet pumps to an air separator tank at an upper level of the boiler house. The water and the ash in the separator tank will flow by gravity to disposal areas.

There will be automatic sequential control for a 20-ton-per-hr system for each boiler. This capacity will handle the additional ash which will be collected when electrostatic precipitators are installed.

Each unit will have a 300,000-sq-ft surface, horizontal, single-pass, double-flow, divided waterbox and hotwell condenser. Each condenser is designed at rated load to condense 3,012,000 lb of steam per hr at a back pressure of 1.67 Hg absolute, with inlet cooling water at 62F.

Heat Rate Good

The Paradise units have been designed for a heat rate of 8,775 Btu per kwhr when operating at 1½-in. Hg back pressure, no makeup and 4% auxiliary power, and a generator output of 700,334 kw. There will be extraction at eight pressure stages. The two lowest and the two highest stages will be from the main turbine. Four intermediate stages will be from the feedwater pump turbine drives.

There will be two nominal half-capacity, barrel-type, five-stage boiler feedwater pumps. Each will have a capacity of 5,300 gpm at a TDH of 9,250 ft. Each pump will be driven by a 15,700-hp, 5,500-rpm, dual-pressure, direct-connected, non-condensing, extraction-type steam turbine designed for variable-speed operation for flow control. These turbines normally will receive steam from the cold reheat line. For startup and low-load operation, there will be supplementary steam from the main steam line at 2,400 psi, 1,050F.

About 70% of full-load rating of the main unit can be carried by each steam-driven pump when the other is out of service. Three motor-driven boiler feed booster pumps (one spare), each having a capacity of 6,000 gpm at a TDH of 240 ft, precede the steam-turbine-driven pumps in the feedwater cycle.

A 4,000-gpm, 7,600-ft TDH, motor-driven pump for each unit will permit starting up the boiler at full pressure and one-third of full-load flow. This pump will be designed for full pressure to permit full-load operation of the unit with one steam-driven pump out of service.

All feedwater heaters will be closed U-tube, two-pass design. The deaerating heater will be a horizontal, cylindrical, non-metering, contact tray type.

(*Continued on page* 84)

Computer System Can Control

IPDC gauges load increments precisely, totals and prints watt-hour-meter data

H. E. KELLEY, Superintendent of Power & Utilities, Goodyear Atomic Corp, Portsmouth, Ohio

Power system interchange billing energy can now be determined precisely on an incremental basis, and hence controlled, by a computer system developed by Goodyear Atomic Corp.

Called the incremental power demand computer (IPDC), this system senses the quantity of energy being registered on a number of watt-hour meters, totals this energy, and prints it with a refined accuracy for intervals of a few minutes. Accuracy of the system is conditioned only by the accuracy of the watt-hour meters furnishing the original intelligence.

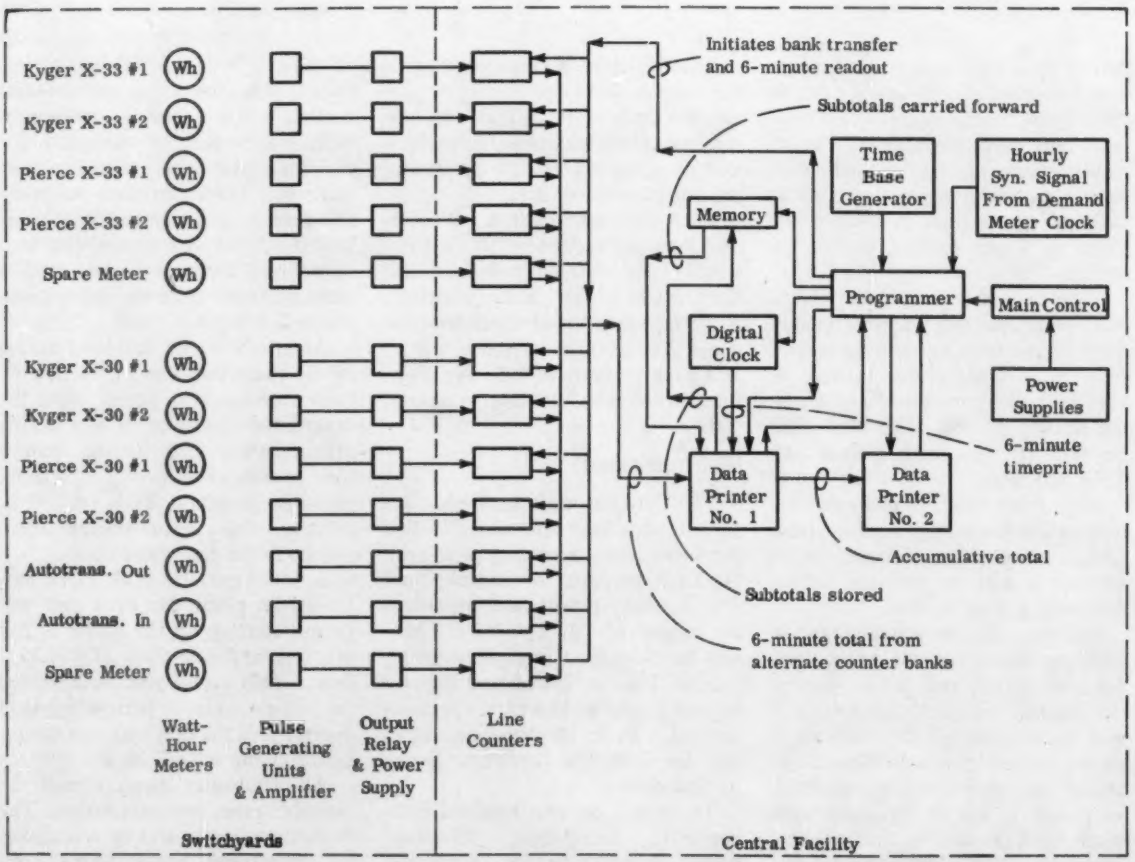
Were the IPDC adopted by utilities, the scheduled power interchange could be maintained precisely, and regulating power would no longer be a superfluous quantity in billing. Utility-company use would involve mounting the pickup devices in the various interchange watt-hour meters throughout the power system.

Impulses generated by the meters would be transmitted via keyed carrier equipment to a central dispatcher's office where the main console of the IPDC would be situated. Thus the dispatcher would be furnished with accurate interchange data at frequent intervals—or continuously, if the equipment is properly modified—for the precise control of generation and for maintaining scheduled interchange power with precision.

The dispatcher would also have an hourly accounting of interchange watt-hour meter readings accurate to a greater degree than is now practicable with today's demand meters. Nor would the watt-hour meters have to be read visually and their readings reported by telephone.

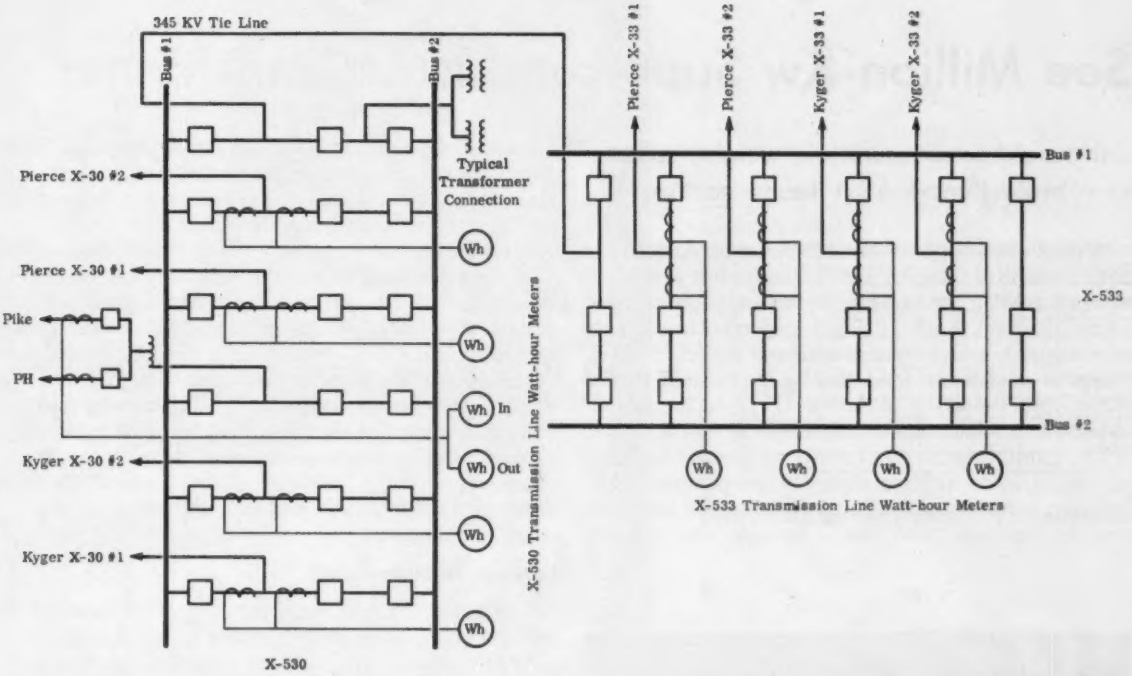
The IPDC's main components are:

1. Pulse generating units
2. Pulse accumulators
3. Programmer and timer
4. Incremental line meter energy printer



SCHEMATIC shows the flow of information from watt-hour meters to the incremental power demand computer where energy readings are totalled and printed with a refined accuracy for intervals of a few minutes

Power Interchange Billing Energy



INTERCHANGE DATA, sensed accurately and at frequent intervals or continuously, allows precise control of generation and the maintenance of scheduled interchange power with the best achievable precision developed to date

5. Total incremental energy and total hourly energy printer.

The pulse generating units consist of a phototransistor, a transistor amplifier, a light source within the 3-phase watt-hour meter, and a power supply external to the meter. Leads from this unit are brought out of the watt-hour meter through additional drawout contacts. The unit detects the rate of rotation of the meter disc by sensing the variation in reflected light from strips painted on the disc. The variation is amplified into pulses representing an incremental quantity of energy flow registered on the meter.

Transmits by Direct Wire

Pulses from the many units in the transmission-line terminal watt-hour meters are transmitted by direct wire to pulse accumulators in the central-office console. These accumulators' two pulse storage units alternately collect the impulses in successive time increment. The programmer and timer fix the intervals and cause the simultaneous switching of pulse accumulators and the reading out of the accumulated impulses into the first printer.

As the accumulator is read, the impulses are cleared. The first printer prints out the energy—number of impulses—registered on each line watt-hour meter for the time interval. The second printer, when directed by the programmer, prints the total incremental energy for the time interval, the accumulated energy at each successive interval within the hour, and the total energy at the end of the clock hour. So the process goes.

Time to the closest 0.1 sec is also printed on the tape for record purposes. At each hour, the timer is self-adjusted to match the exact clock hour used for billing.

The IPDC, developed for the Atomic Energy Commission [Contract AT-(33-2)-1], has been used in the special circumstances obtaining at the gaseous diffusion plant at Portsmouth, Ohio, where Goodyear Atomic is the operating contractor. The industrial power loads in the quantities of energy prevailing there are peculiar to that type of plant.

But other industrial plants may have sufficiently heavy loads, along with clauses in power contracts which could warrant the IPDC's use in determining incremental loads advantageously. Most industrial power-supply contracts have provisions making the limitation of demand an economic necessity. Characteristics of many loads also are conducive to at least some control of demand to avoid excessive demand charges.

Can Control Load, Hourly Demand

In the gaseous diffusion process, it is feasible to control load and hourly demand within a small fraction of 1%, when the load level is known precisely and at close intervals, that is, before hourly demand is a matter of history. The economic incentive present, the IPDC has its use here, where the accuracy required of the load indicator is greater than that obtainable with the standard telemetering equipment, even when modified for ultimate sensitivity.

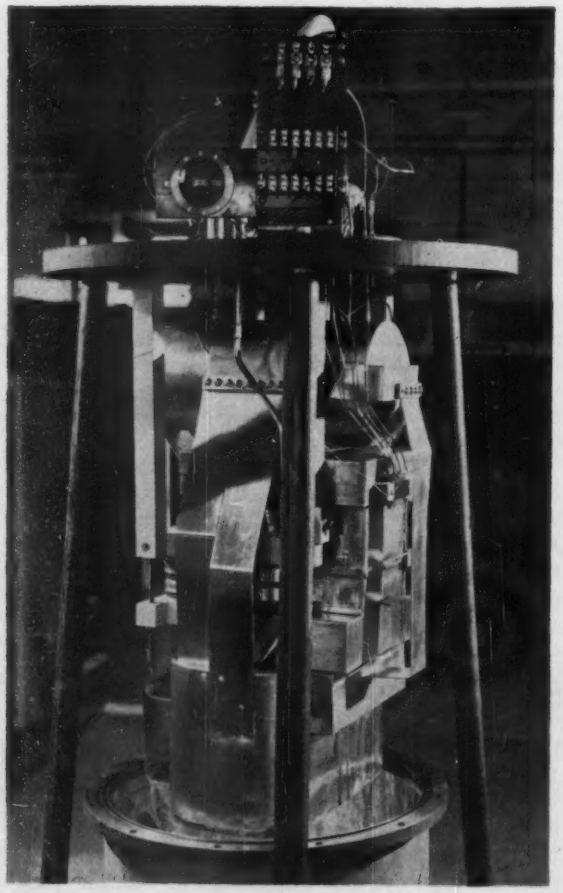
See Million-Kw Superconductor Transformer

Unit would save insulation, weight, space; new protection against faults necessary

A pilot-model transformer with superconductor coils gives promise of reducing power transformer weights by as much as 90% and making the million-kilowatt transformer practical. Such a power transformer would have zero copper loss and reduced core and dielectric losses. The pilot model was developed by Dr Richard McFee of Syracuse University at Arthur D. Little Inc laboratories, where it has been successfully operated at 15 kw.

The transformer incorporates a refrigerator for cooling the coils to superconductivity temperature. The coils are thermally and electrically insulated from the case by vacuum, with leads brought out through vacuum-tight bushings. Because strong magnetic fields can quench the superconducting state, the primary and secondary windings are interleaved so that currents in adjacent layers flow in opposite directions. They set up opposing magnetic fluxes that nearly cancel each other.

Because the coils give off no heat, they can be placed close together in a power transformer to yield a more compact design than in present fluid-cooled transformers. Space and weight savings can also be effected in coil insulation. Because insulation strength improves at low temperatures, insulation can be thinner. And no margin in insulation thickness need be provided to take care of chemical degradation, for at these temperatures degradation of the insulator material essentially disappears. Dielectric loss becomes a fraction of that at room temperature.



15-KW PILOT MODEL has demonstrated superconductor transformer principle. Copper loss is zero, core loss reduced

Leakage Heat Removed

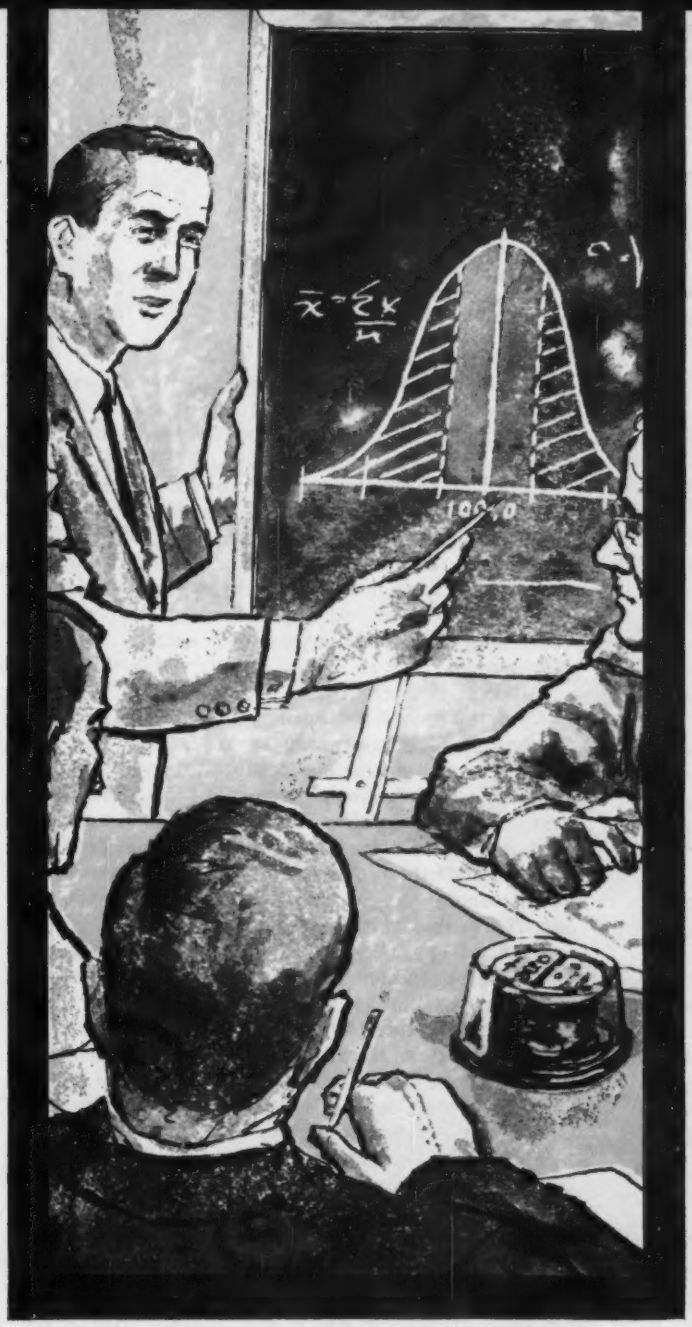
The major load on the refrigerator is the removal of leakage heat into the coils from outside the transformer, most of it through the coil leads. This leakage, however, can be small with superconductor leads because superconductors, though having extremely high electrical conductivities, display low heat conductivities. One candidate for these leads is a recently developed niobium-tin alloy that maintains superconductivity to 17K (—256C). A. D. Little's Gifford-McMahon helium refrigerator, now in the final stages of development, is expected to maintain 4.2K for months of unattended continuous operation. Heat leakage is also hindered by liquid-nitrogen heat shields. In a 300,000-kw power transformer, the refrigerator consumption would be about 50 kw.

The core, which is thermally insulated from the cold coils, is held at room temperature by water cooling. Because of the compact coil design, the net mass of iron is reduced with attendant reduction in the core's hysteresis loss.

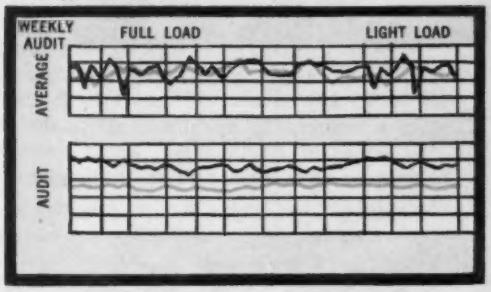
Potential application is in the larger sizes, starting with substation installations. The extra cost of the refrigeration equipment and maintenance of its moving parts make distribution sizes impractical.

Under steady loading, the superconductor-coil transformer will operate like an equivalent-rated conventional unit. It has not the same tolerance, however, to overload currents and will require new protective schemes or devices. Excessive currents could quench superconductivity and put the transformer out of service for a minute or more. Overvoltages can be handled as at present.

Partly because of these protection considerations, exact savings in weight and space have not yet been figured. The weight saving should be at least 50%. On the consideration of steady loading only, the protection aside, weight could be reduced to 10% of present values.



Continuous quality audit, using recognized statistical sampling procedures, is kept on G-E single- and polyphase meters.



Sustained accuracy and reliability of G-E magnetic-suspension meters makes statistical sampling feasible.

ANOTHER GENERAL ELECTRIC METERING EXTRA . . .

Statistical sampling seminars spark ideas

With the operating cost breakthrough possible — an estimated $70 million annual savings to utilities by 1971— statistical sample testing is one of today's most important meter study areas.

To provide electric utilities with an idea-center where statistical sampling techniques, (which permit programming of tests to obtain desired meter performance with optimum expenditure) are advanced and discussed, General Electric has pioneered and sponsored a number of special seminars at its meter plant in Somersworth, N. H. During the past three years personnel from some 77 utilities have attended these three-day informational seminars.

As its contribution to the seminars, G.E. shares its knowledge of statistical techniques gained from over 10 years of practical experience in applying them to meter manufacture. General Electric also helps advance understanding of statistical meter sampling by supplying utilities with articles, bulletins and technical data. For more information on statistical sample testing, or any metering subject, contact your General Electric Sales Engineer. 713-12

YOU GET ALL 10 METERING EXTRAS FROM GENERAL ELECTRIC

- Jet Stream Service
- Statistical Sample Testing Seminars
- Certified Quality
- Meter Courses
- Low Cost per KVA
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- Product Service
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GENERAL ELECTRIC

ELECTRIC UTILITY METHODS

CONSTRUCTION

Structure Code Saves Time

DEAN W. PALMER, Design Specialist, Kansas Gas & Electric Co, Wichita, Kan.

Marking or coding of trusses and columns which make up the standardized substation structures (from 2.4 to 69 kv) used by Kansas Gas & Electric Co saves a tremendous amount of office design labor. This means of identification, which considers each column or truss as a unit in itself, eliminates the need for steel assembly drawings. Structurally, only electrical drawings, or layouts, are made for office use in planning, estimating and design, and for field use in assembly.

KG&E uses lattice-box columns and trusses for 69-kv structures and interlaced columns for lower voltage structures. Basic components for 69-kv substations are comprised of one column and three trusses. The columns are 3-ft square, designed in lengths of 7, 14 and 22 ft. The normal column is 29 ft long (one 22-ft plus one 7-ft section). Common trusses come in depths of 2 ft and 3 ft, with one type of platform truss 7 ft deep.

Columns for 12 kv involve two 6-in. channels, 28 in. out-to-out, internally laced and 22 ft high. Front columns are double laced; rear columns, single laced. Although the predominant use on KG&E's system is 12 kv, the columns are used also for 2.4-kv, 4-kv and 22-kv substations. Because of adherence to the standard structures, all columns, trusses and other components of 1961 structures are readily interchangeable with those erected earlier.

The coding of these members and components is based on a separate set of identifications wherein each "mark" number has a special meaning. By assuming that each column or truss is a unit, the total number of pieces for each unit generally is kept to ten or less. This has permitted a code con-

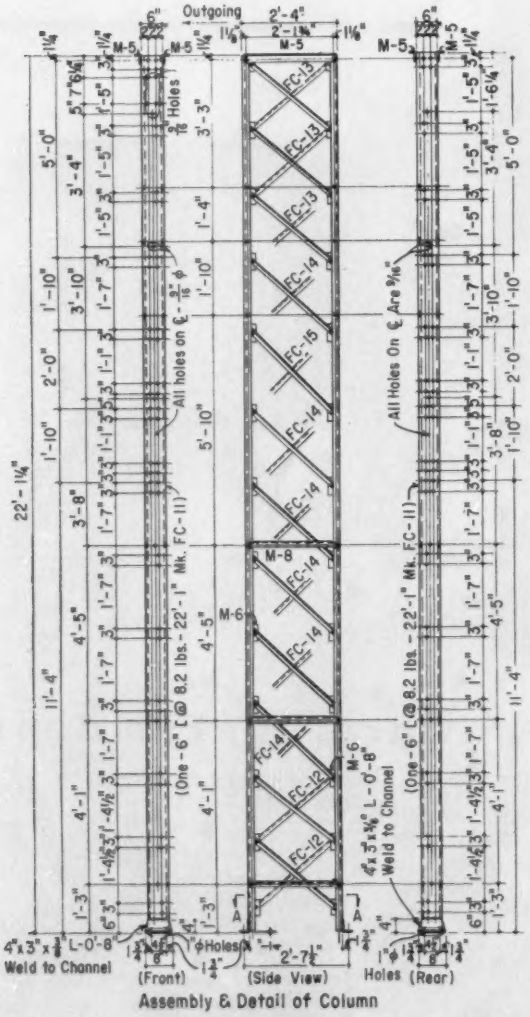


FIG. 1—**DOUBLE-LACED COLUMNS** for 12-kv structures are called FC-1, with two main channels FC-10, FC-11. Angles making up the lacing are coded FC-12 to FC-15

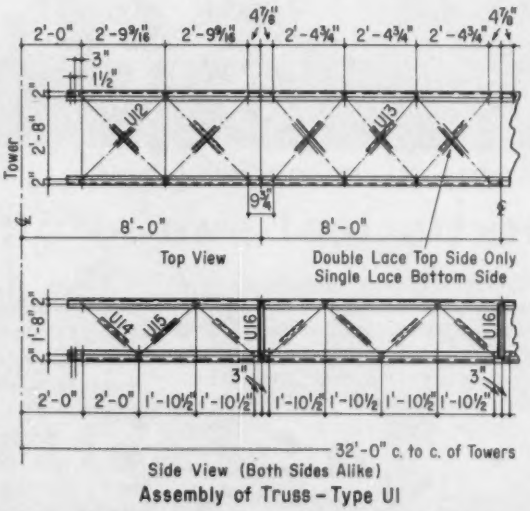


FIG. 2—**MAIN MEMBERS** of U-1 truss for 69-kv structures are coded U-11 to U-16. Angles making up lacings are shown on complete drawing of assembly and steel details

in Office and Field

sisting of a letter and numeral with the same first common digit. Two examples illustrate this code:

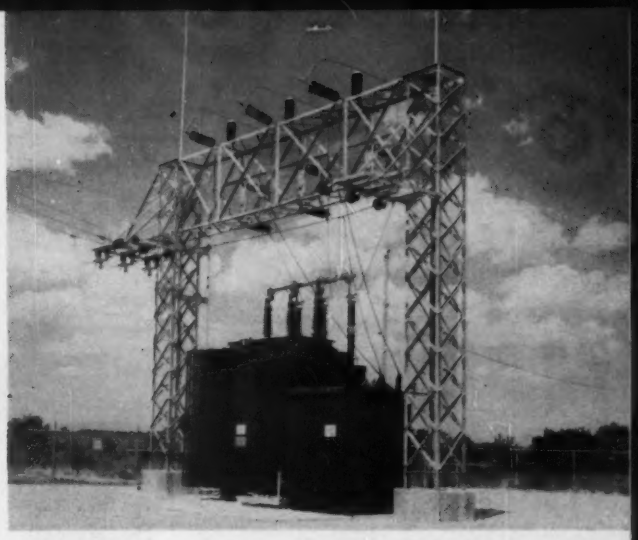
1. The 22-ft, 12-kv double-laced columns, as used on the front of the structure, are called FC-1. The two main channels are marked FC-10 and FC-11. The four angles that make up the lacing are identified as FC-12, FC-13, FC-14, FC-15. The structure is illustrated in Fig 1.

2. One 2x3-ft truss is called a U-1 truss. The main members are marked U-11. The five 2x1½-in. angles that make up the lacing are marked U-12, U-13, U-14, U-15 and U-16. One view of this truss is shown in Fig 2.

All steel details follow the same pattern in marking, and each column or truss is on its own drawing. Each drawing contains the detail of each piece in addition to the assembly of the complete unit. Therefore, any workman seeing a member marked U-12, or G-22, or FC-15 knows immediately to what column or truss it belongs.

The same pattern is used for odd pieces to hang the units together. Odd pieces for the low-voltage structure are marked M-1 to M-55 consecutively (to date); odd pieces for the 69-kv structure are K-1 to K-38. Each group is on a separate drawing. In addition to the detail of the member itself, a brief description of its use also is provided. This eliminates looking all over the drawings to find out where the pieces go. Examples of this are given in Fig 3.

Because there are no 12-kv trusses, cross numbers are necessary. These are called CM-1, CM-2, CM-3, etc, and they too are on their own set of drawings. Here, instead of a description of its use, a sketch is drawn at the end of each detail which shows how it is used. (See Fig 4)



As a further aid to office and field personnel, other sketches are individualized to illustrate ways and means of connecting up the various columns and trusses. The clips, angles and plates needs to connect trusses to columns in various combinations are sketched. About 14 illustrations are available for office and field personnel. In addition to showing the location of each piece, the total of all pieces required for each connection is given to eliminate the counting of individual pieces.

To design a structure using the code, only electrical drawings are made and only those trusses or pieces are coded that need identification as to the type number, or code, of the complete unit: U-1, G-1, PT, etc. However, the 12-kv columns are not identified. If the column is on the front, it is double-laced; if it is on the rear, it is single-laced. The electrical drawings will show this automatically. Because only two gusset plates, single and double, are used, they also are not coded.

The cross members (CM-1, CM-2, etc) on the front and rear of 12-kv structures are identified but only as a matter of convenience for use in the field. They are otherwise identified as to use on the detail drawings.

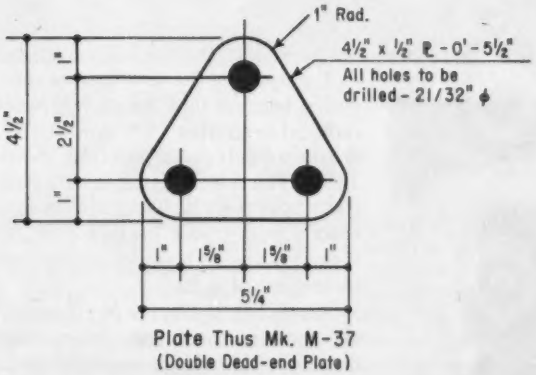


FIG. 3—ODD PIECES that tie together main components of 12-kv structure are included on one drawing (shown partially). Details of each piece, plus its use, are described

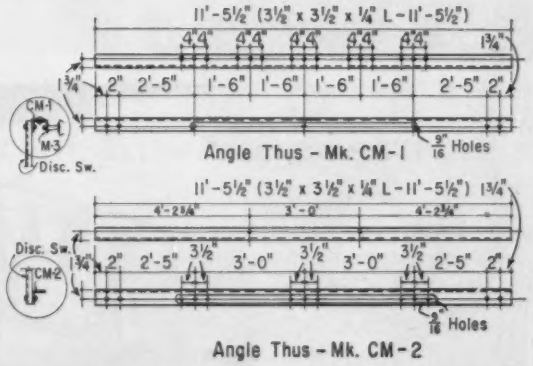
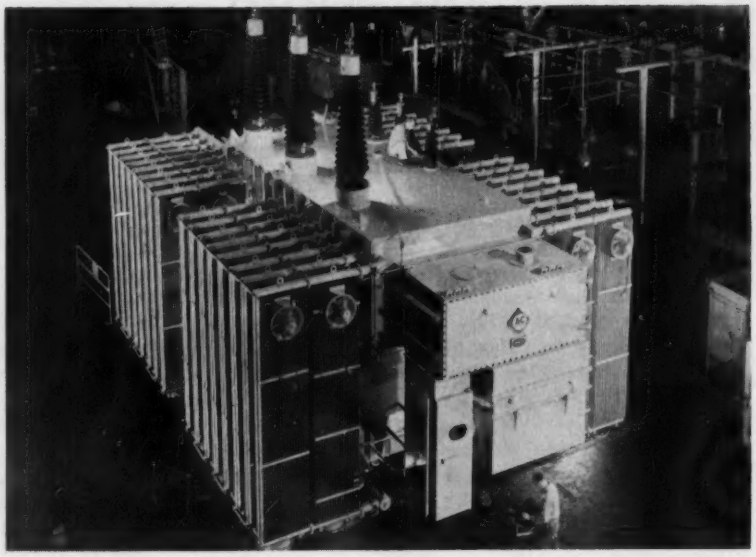


FIG. 4—CROSS MEMBERS for 12-kv structure are coded CM-1, CM-2, etc. A sketch at the end of each detail shows how the member is to be used in the structure

Transformer Designs Cut Weight, Dimensions

Weight of special design A-C three-phase power transformer cut by 22%



Three-phase power transformer, shipped recently by Allis-Chalmers Mfg Co to Southern California Edison Co's Ellis Substation, is 22% lighter than previous units of the same rating. Weight saving of some 85 tons is attributed by the manufacturer to the fact that the 150/200/250-Mva unit, with 220-kv grounded wye to 72-kv delta, does not require an auxiliary series transformer for load-tap changing. A standard load-tap changing mechanism incorporated in the delta winding, Type TLB, performs this function.

Further weight saving was realized because the unit could be shipped upright and completely assembled, except for cooling equipment, bushings, and oil, and an ordinary depressed-center railroad car could be used. Other designs, says A-C, have required a very special two-section rail car and heavy bridging understructure on the transformer.

Two other such units will be shipped to the substation, located in Santa Ana, Calif., later this year.

Floor space requirements, tank height and weight of GE 'preferred design' power transformers are reduced

Greater mobility, easier station change-outs and longer service life are among the stated advantages of redesigned power transformers recently announced by the General Electric Co.

Length and width of GE's "preferred design" substation transformers rated up to 25-kva, have been reduced by using sealed-tank oil preservation and by moving the radiators from the end over to where they hug the side of the transformers. The cut in the floor space requirements simplifies station change-outs because existing transformers can now be replaced with higher-rated units of the new design without requiring extensive substation rebuilding.

Transport of the new units is simplified because tank height has been reduced from over 15 ft down to 12 ft and weights have been cut about 10%. The lower height means that transformers on highway trailers can readily pass under bridges built to former federal highway minimum clearances of 4 ft.

According to George H Hupman, GE power transformer marketing manager, the design changes were the result of suggestions offered by 32 utilities and consulting firms interviewed last year.

(*More News of Manufacturers, p* 61)

INDUSTRY'S FIRST FULL LINE OFFERS

The right oil cutout at lowest cost

With the addition of a new, 15-kv, 200-ampere, sealed oil cutout to its line of quality cutouts, General Electric assures you of exactly the *right* cutout—vented *or* sealed—to meet your specific needs from 5.2 through 15 kv.

Now you can be *completely specific* with your cutout investment: buy G-E *vented* cutouts for the majority of your applications—they're completely adequate but much less expensive; buy G-E *sealed* cutouts only for such applications as submerged sites or hazardous atmospheres.

When you select from General Electric's full line of oil cutouts, you are assured of positive load break, high current-interrupting capacity, and a full range of cable terminations for fast, easy installation.

For more information on the smallest, lightest, most economical cutouts in the industry, contact your General Electric Sales Engineer. Or, write for Bulletin GEA-7191, to General Electric Company, Section 488-07, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

FOR POWER MEASUREMENT

Bi-directional power monitors, 2 to 1000 MC, 1 to 1000 watts!

- **Four power level ranges with each plug-in**
- **Power range down to 1 watt full scale**
- **Nine plug-ins for wide frequency coverage**
- **Linear scale on all power ranges**
- **No correction factor required for calibration on any range**

Power is read directly on a linear scale with accuracy of ±5% on Sierra 164 Series Bi-Directional Power Monitors, which permit intermittent or continuous measuring of incident and reflected power, plus convenient matching of loads to lines. Direct connecting, they measure forward and reverse power merely by turning a plug-in control. No connections to switch.

Complete frequency coverage is provided with nine plug-in elements, each offering four power ranges selectable by the turn of a knob. Power capacity ranges from 1 watt full scale to 1000 watts full scale, frequency coverage from 2 to 1000 MC. Plug-in versatility is indicated in the adjacent table.

Calibration is adjustable on each range independently, so that no correction factor need be applied. The power monitors are available with Type N, C, LC, HN or UHF male or female connectors. High directivity and low insertion VSWR assure maximum accuracy with minimum disturbance to the transmission line under test. No auxiliary power is required.

Sierra Model 164
Power Monitor, $110.00.

PLUG-IN ELEMENTS FOR MODEL 164

Model	Full-Scale Power (Watts)	Frequency Range
180-52	0-1/5/10/50	25-52 MC
180-148	0-1/5/10/50	50-148 MC
180-470	0-1/5/10/50	144-470 MC
180-1000	0-1/5/10/50	460-1000 MC
181-250	0-10/50/100/500	25-250 MC
181-1000	0-10/50/100/500	200-1000 MC
270-30	0-50/100/500/1000	2-30 MC
270-75	0-50/100/500/1000	10-75 MC
270-470	0-50/100/500/1000	70-470 MC

Plus these Power Measuring Instruments

Directional Couplers for VSWR, reflection coefficient, power measurements, 1 to 1200 MC. Seven models available covering power levels to 1000 watts. $120 to $150.

50-Ohm Coaxial Loads, including the new 160-1200 three-way termination, 0-1000 MC, with associated accessories for power capacities of 1200, 2000 and 3000 watts. Model 160 Series Loads also available in 1, 5, 20, 100 and 500 watt sizes.

Low Pass Filters, to 400 MC, provide low insertion loss (max. 0.4 db in pass band), sharp cut-off, max. 1.5 VSWR, rejection greater than 60 db from 1.25 to 10 times cut-off frequency. Five models, cut-off 44, 76, 135, 230, 400 MC. Power range, 250 watts in pass band, 25 watts in rejection band. $100 each.

Termination Wattmeters: Sierra Series 185 average-reading termination wattmeters, to terminate rf coax lines and measure rf powers, 2 models 0 to 30/100 and 0 to 150/500 watts, 20 to 1000 MC, accuracy ±5%, max. VSWR 1.2. Model 185A-100, $260; Model 185A-500, $375.

Data subject to change without notice. Prices f.o.b. factory

7307

Sierra

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Sangamo Will Relocate And Expand Facilities

Sangamo Electric Co recently announced a program of realignment and relocation of production facilities, including expansion of a present plant and the construction of a new plant in South Carolina, in a move to improve manufacturing efficiency and to anticipate growth of its business in the very near future.

A first step in the program will be an immediate 65,000-sq-ft expansion of the the Pickens, South Carolina, plant—the Pickens plant produces electrolytic and power-factor correction capacitors. The capacitor production facility now located at Marion, Illinois, will be transferred to the expanded Pickens plant. The Marion plant will be closed.

Furthermore, construction will be started at once on a new 150,000-sq-ft plant in Walhalla, S. C., for the manufacture of certain types of single-phase electric meters now produced at Springfield. The Pickens and Walhalla plants will be operated as one division of the company. The new Walhalla plant will provide space relief in the Springfield meter-assembly areas which will permit better quality control in the assembly and test of meter units still to be made in Springfield.

Multi-Amp's New Plant In Operation

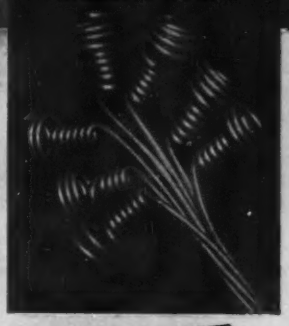
Multi-Amp Electronic Corp's engineering department is conducting research and design work for special units to meet customers' specifications in new headquarters in Cranford, N. J.

The company designs, engineers, manufactures and sells portable field and laboratory equipment for testing and calibrating current and voltage-actuated devices.

Significant features in the plant include: (1) expanded customer laboratory; (2) extensive environmental test facilities; (3) increased research facilities; (4) improved production-line techniques; (5) facilities for handling heavier equipment; and (6) more efficient inventory control for better customer service.

Crapo GALVANIZED **STEEL STRAND**

Mandrel Test*



Checked and Double-Checked by Laboratory Technicians

Every coil of wire used in the manufacture of *Crapo* Galvanized Steel Strand is tested and approved by trained laboratory technicians. Samples from both ends of each individual coil are subjected to a series of prescribed tests before stranding. Then, the finished strand is re-checked to make certain that it conforms in every respect to established specifications and our own high quality standards.

Thus you know when you specify *Crapo* Galvanized Strand that every precaution has been taken to assure maximum performance in the finished product.

Write for Free Booklet

"The Story Behind Crapo Galvanized Wire and Strand" illustrating and describing manufacturing techniques and testing procedures. Ask for Booklet B-59!

*Determines ductility of wire and adherent quality of galvanizing.

AVAILABLE IN 3 COATING WEIGHTS

FOR GUYS, MESSENGER AND OVERHEAD-GROUND WIRE

Crapo Steel Strand is available in all standard sizes and grades and in Class A, B and C galvanized coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

NEW Techniques and NEW Equipment make line maintenance SAFER, SIMPLER, MORE PRODUCTIVE

By O. G. "Andy" Anderson, Product Manager

Men responsible for power line construction and maintenance are constantly looking for greater SAFETY, SIMPLICITY and PRODUCTIVITY.

The development of insulated booms and platforms or buckets provides a new method of reaching these objectives.

In studying the possibilities for this new aid to maintenance work and at the same time keeping Safety in mind as we have always done in developing hot line maintenance methods, we have reached this definite conclusion. Where insulated platforms can be maneuvered into position, the safest practice is to combine them with insulated tools. That's why Chance demonstrators, who have accumulated years of service with the elite of the pole climbing fraternity, join the "bucket brigade" when the job justifies the means . . . as when they combined hot line tools and power tools with insulated booms and buckets for the switch installation shown above, at right.

This method allows hot line maintenance crews to work with only one set of safety rules. There is no need to decide which safety rules to follow and crews are not confronted with the risk and confusion of alternating the long standing habit of working at ground potential with an entirely new procedure of working at line potential.

The A. B. Chance Company has teamed up with the Pitman Manufacturing Company, to work with your supervisors and line crews in developing the most efficient procedures for this combination of tools and equipment.

A. B. CHANCE CO. CENTRALIA, MISSOURI

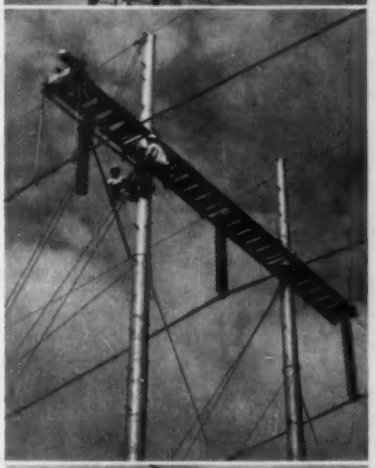
A. B. Chance Co. of Canada, Ltd., Toronto

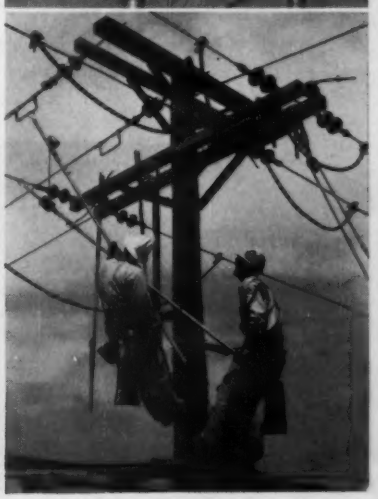
CH61-25

Chance demonstrators have the job of helping Chance customers get the highest productivity from their line crews with the greatest simplicity and safety. They, too, continually look for, and help develop better, easier, safer ways to do the many and varied jobs of line maintenance men.

As linemen, with the responsibility of demonstrating new methods to line crews, they never forget the most important word in their vocabulary . . . SAFETY. In their search for better and more productive advances in hot line work, they give first consideration to the safety of the men who must do the work.

Here, demonstrator Don Collins shows a midwestern line crew how to use the new Chance power compression tool. Line crews and their supervisors learn dozens of special techniques from these demonstrators. The entire Chance demonstrator "team" is shown at right.





INSULATED BOOM AND BUCKET USED WITH INSULATED TOOLS. A good example of this combination is shown above where hot sticks were attached to the pole to support a jumper, while insulated power tools and hand tools were used from an insulated bucket to "cut-in" a three-phase switch. This job was completed in record time without service interruption and without climbing the pole.

HOT STICK HANDLING OF BUNDLED CONDUCTOR. In the photo at top right, demonstrators and utility personnel use specially designed Chance Hot Sticks for handling energized bundled conductors while changing insulator strings on a 460 KV system. This method of insulator replacement has proved highly successful.

HOT STICK TROLLEY DEMONSTRATED. Another job simplification is shown in photo, middle right, where a Chance developed Hot Stick Trolley is used to transfer insulators for replacement on guyed steel H frame structure. This same technique is used on towers or wood H frames to bring insulator strings to an easily accessible position for making unit replacements.

PHASE TESTING DEVICE. A new Chance phasing tester is used, lower photo at right, to demonstrate how to determine correct phasing relationships before joining two circuits together.

Regardless of whether the job can be done from the pole or from an insulated platform, Chance Epoxiglas (glass reinforced resin) tools and insulated power tools help to make hot line maintenance work Safer, Simpler and More Productive.

Don Collins
Centralia, Mo.

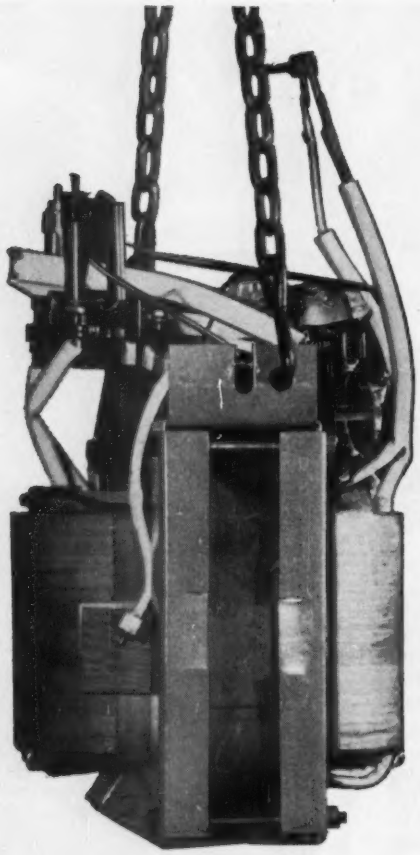
Bob Bond
Roy, Utah

Bob Boehmer
Wheaton, Illinois

Bill Shreve
Burlington, N. J.

"Cliff" Bosch
Birmingham, Ala.

Vern Moody
Dallas, Texas



Rebuild Transformers with WAGNER® CORE AND COIL ASSEMBLIES

Now, more than ever – when you rebuild transformers – it's what goes into the tank that makes the difference. And when you put Wagner® Form W and Form P replacement core and coil assemblies in your rebuilt transformers, the difference is the *quality* your dollars buy.

Wagner replacement assemblies are full NEMA Standard elements, like those used in new Wagner distribution transformers. They give you the advantages of high-efficiency, low exciting current, low impedance, high short circuit and overload capability. These small, light assemblies let you get the most out of uprating, too. In sizes through 15 Kva, you can install the largest core and coils that will fit your tank, and still remain within NEMA temperature rise standards.

Wagner Form W (5 through 50 Kva) and Form P (75 through 167 Kva) replacement assemblies come to you ready to install. They have been fully tested, vacuum-treated and dried, and are packaged in transformer oil for complete protection. Universal mounting brackets are included with each unit, 25 Kva and smaller.

When you rebuild transformers, specify Wagner replacement assemblies. They're a good investment ... that you can count on.

GET LOWER IMPEDANCE VALUES

BETTER REGULATION

LOWER CORE LOSSES

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

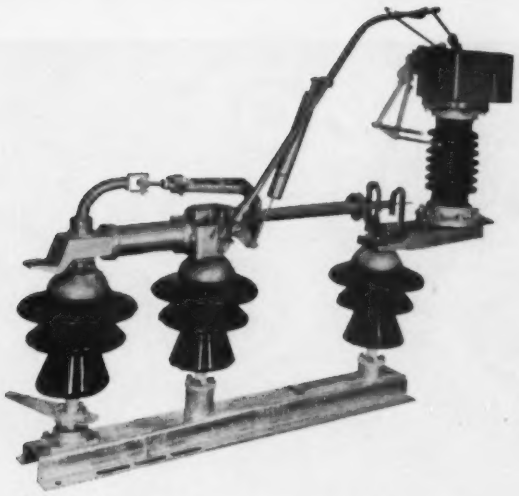
Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.

Manufacturers of LOCKHEED® Products

WB 61-2

New Equipment

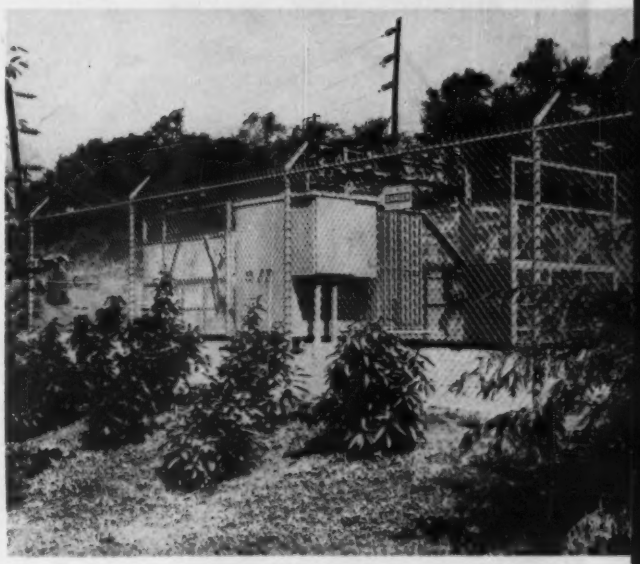


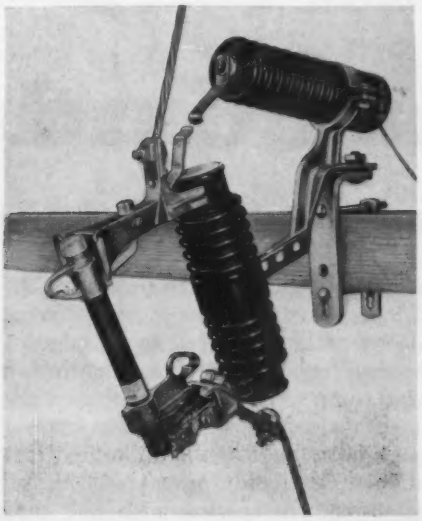
Load-Break Switch . . .

. . . features SF6 interrupter with modified paralleling auxiliary blade. Interrupting ability of the V-2LB switch, for outdoor use, is 600 amp of load current at 50% pf, 15 through 138 kv. The switch also handles transformer magnetizing current up to 100,000-kva banks at 138 kv and single capacitor banks up to 10,000 kvar at 138 kv.
Westinghouse Electric Corp, Pittsburgh 30, Pa.

Chain-Link Fencing . . .

. . . for outdoor transformer and switchgear installations in suburban areas is aluminum, treated with an especially developed chemical conversion coating, "alodine." "Alodine" fencing is said to provide long-lasting light green finish without the use of paint, to exceed corrosion-resistance of untreated aluminum fence, to eliminate objectionable glare as much as 30% and reduce over-all maintenance. Alodine is an amorphous phosphate-chromate which reacts chemically with aluminum to form a hard, thin coating which becomes an integral part of the metal. Reportedly, it will not flake, peel or chip and has excellent thermal-shock properties so that it readily contracts and expands with the base metal. The finish is said to harmonize well with landscaping. As well as the fence links, all posts, uprights, tie-rods, fasteners and rails are "alodized"—including pieces up to 25 ft long. Heights of fencing up to 8 ft and in 1-in. or 2-in. mesh are available.
Amchem Products, Inc, Ambler, Pa.

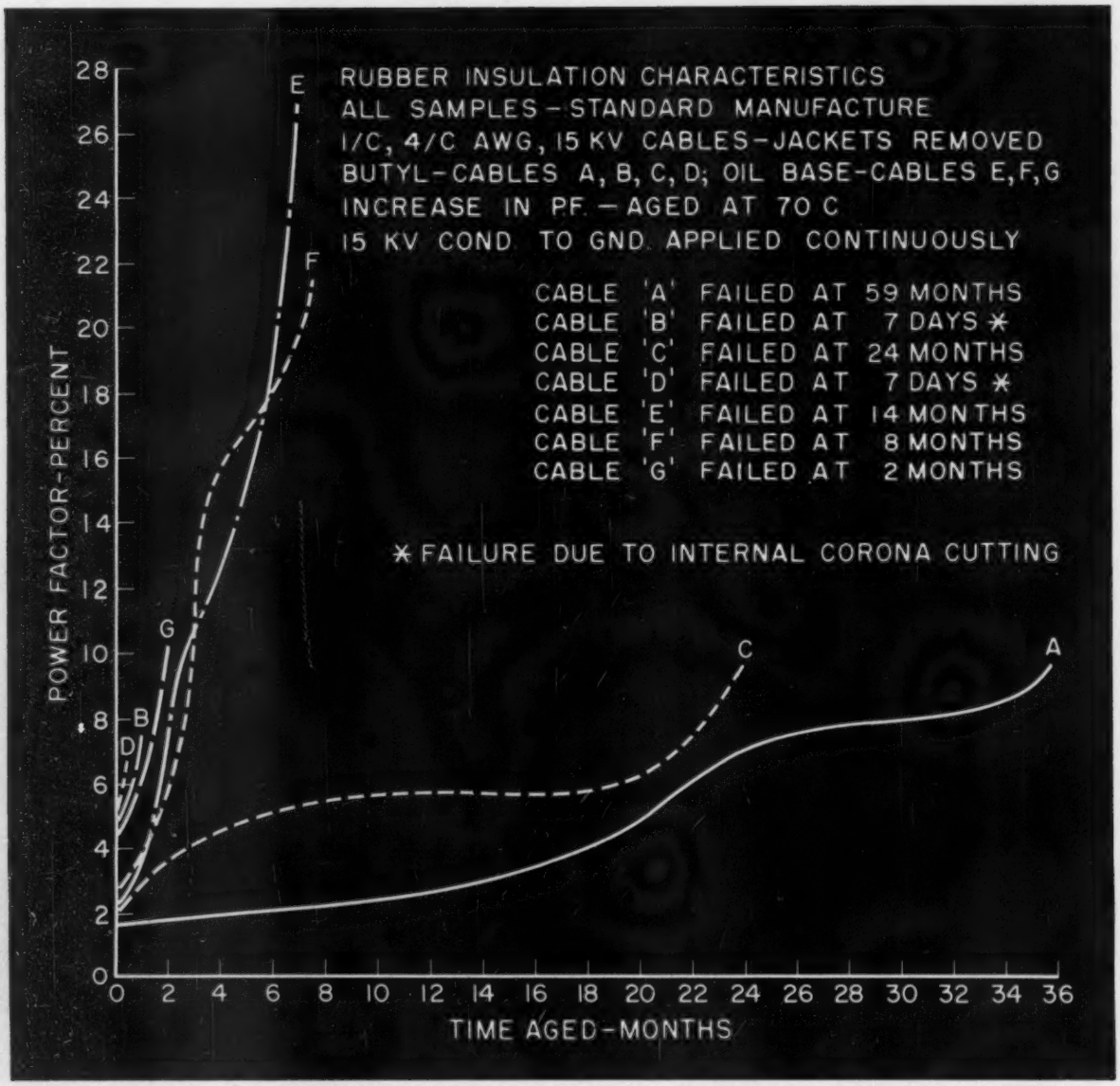




Arrester-Cutout Combo . . .

. . . features Unigap valve arresters used with GX, HX and Trip-O-Link cutouts in 7.8 and 15 kv ratings. Arrester ratings include 3, 6, 9, 10, 12 and 15 kv. Combo is said to offer advantages over separately-mounted units. Reportedly, units can be installed more quickly and more easily, require less space on the crossarm and assure permanence of preset gap electrode spacing. Combinations are available on a choice of crossarm, pole or transformer mounting brackets, plus a T-bracket for side-by-side mounting of arrester and cutout. All mounting brackets have been designed to allow the entire unit to be pivoted horizontally and positioned at any desired angle to the crossarm for maximum convenience of cutout re-fusing or servicing. Units are shipped pre-assembled.
James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

(More New Equipment on page 68)


RUBBER INSULATION CHARACTERISTICS
ALL SAMPLES - STANDARD MANUFACTURE
1/C, 4/C AWG, 15 KV CABLES - JACKETS REMOVED
BUTYL - CABLES A, B, C, D; OIL BASE - CABLES E, F, G
INCREASE IN P.F. - AGED AT 70 C
15 KV COND. TO GND. APPLIED CONTINUOUSLY
CABLE 'A' FAILED AT 59 MONTHS
CABLE 'B' FAILED AT 7 DAYS *
CABLE 'C' FAILED AT 24 MONTHS
CABLE 'D' FAILED AT 7 DAYS *
CABLE 'E' FAILED AT 14 MONTHS
CABLE 'F' FAILED AT 8 MONTHS
CABLE 'G' FAILED AT 2 MONTHS
* FAILURE DUE TO INTERNAL CORONA CUTTING
POWER FACTOR-PERCENT
TIME AGED-MONTHS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
A
B
C
D
E
F
G

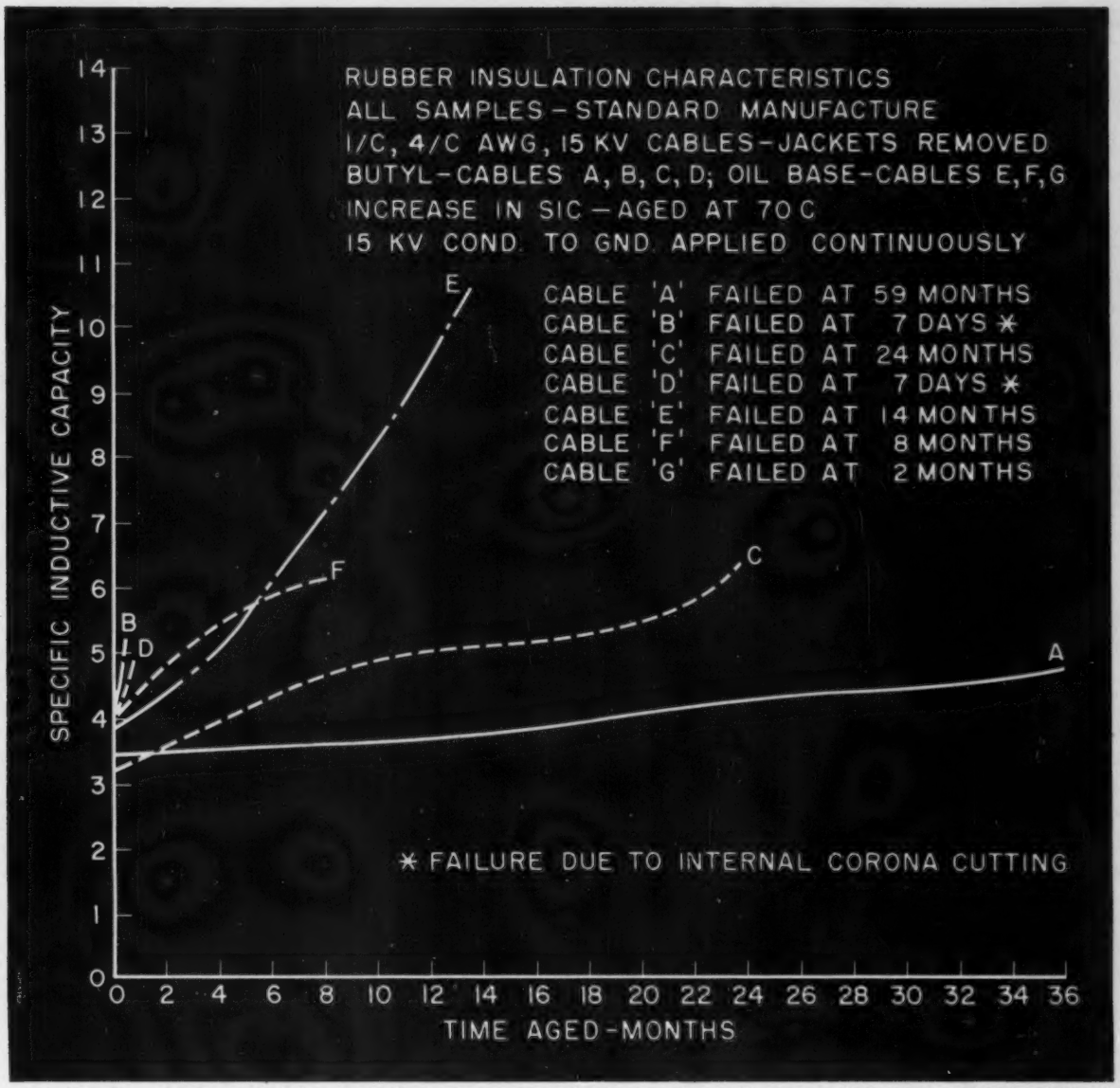
DURASHEATH LASTED TWICE AS LONG AS NEXT-BEST RUBBER CABLE. Cables were submerged in water heated to 70C, and 15000 volts conductor-to-ground applied

Anaconda

These accelerated-life tests prove

Anaconda proved the big difference in rubber insulations by buying competitive cables on the open market, taking a random sample of an Anaconda Durasheath cable out of stock, and running them all through a five-year *underwater test at 173% RATED VOLTAGE*. This extra-rugged non-standard test comes closer, on an accelerated basis, to correlating cable performance under actual operating conditions than any industry test. As you can see, Anaconda Durasheath ("A" in the chart) lasted more than twice as long as the next-best cable—59 months compared to 24 months.

Durasheath quality is the result of three factors: Superior compounds resulting from years of developmental research and constant improvement; advanced techniques of manufacture; and better ingredients. For instance, Anaconda Butyl (AB) insulation is compounded with only nonhygro-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CABLE 'F' FAILED AT 8 MONTHS
CABLE 'G' FAILED AT 2 MONTHS
* FAILURE DUE TO INTERNAL CORONA CUTTING
SPECIFIC INDUCTIVE CAPACITY
TIME AGED - MONTHS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
A
B
C
D
E
F

continuously. Where other cables had failed completely, Durasheath's power factor (line A, left) had increased from 1.5 to only 7.1; SIC (line A, right) from 3.5 to 4.3.

proves it!

there is a difference in rubber insulations

scopic fillers to prevent increase in power factor by moisture absorption.

Durasheath's superiority is now further improved by a uniquely new "Uniblend" mixing process which literally homogenizes the Butyl mixture, disperses all the components thoroughly to prevent variations in the high dielectric strength of Anaconda Butyl (AB) insulation.

For more facts on Durasheath and Anaconda's new Uniblend mixing process, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-2-EW. 61249

ASK THE MAN FROM

ANACONDA®

FOR DURASHEATH BUTYL-INSULATED CABLE

"Of course I know what the trick is. He's using CF&I Galvanized Strand."

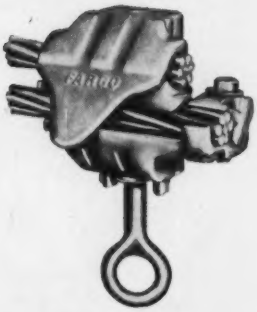
While we can't guarantee that CF&I Galvanized Steel Strand can do the old Indian rope trick, we *do* know that there's no better strand for overhead ground wire.

As a result of some modern engineering and production techniques, CF&I Galvanized Steel Strand offers you a unique combination of flexibility and corrosion-resistance. It is subjected to the most rigid quality controls during manufacture . . . hot-dipped in zinc before stranding to assure a tough weather-resistant finish . . . and made to meet ASTM specification A-363 in three- or seven-wire constructions. Or, it can be tailor-made to your particular requirements.

For complete details and prompt delivery, contact your electrical distributor today.

8239-A

The Colorado Fuel and Iron Corporation
Denver • Oakland • New York
Sales offices in Key Cities



Hot Line Connector . . .

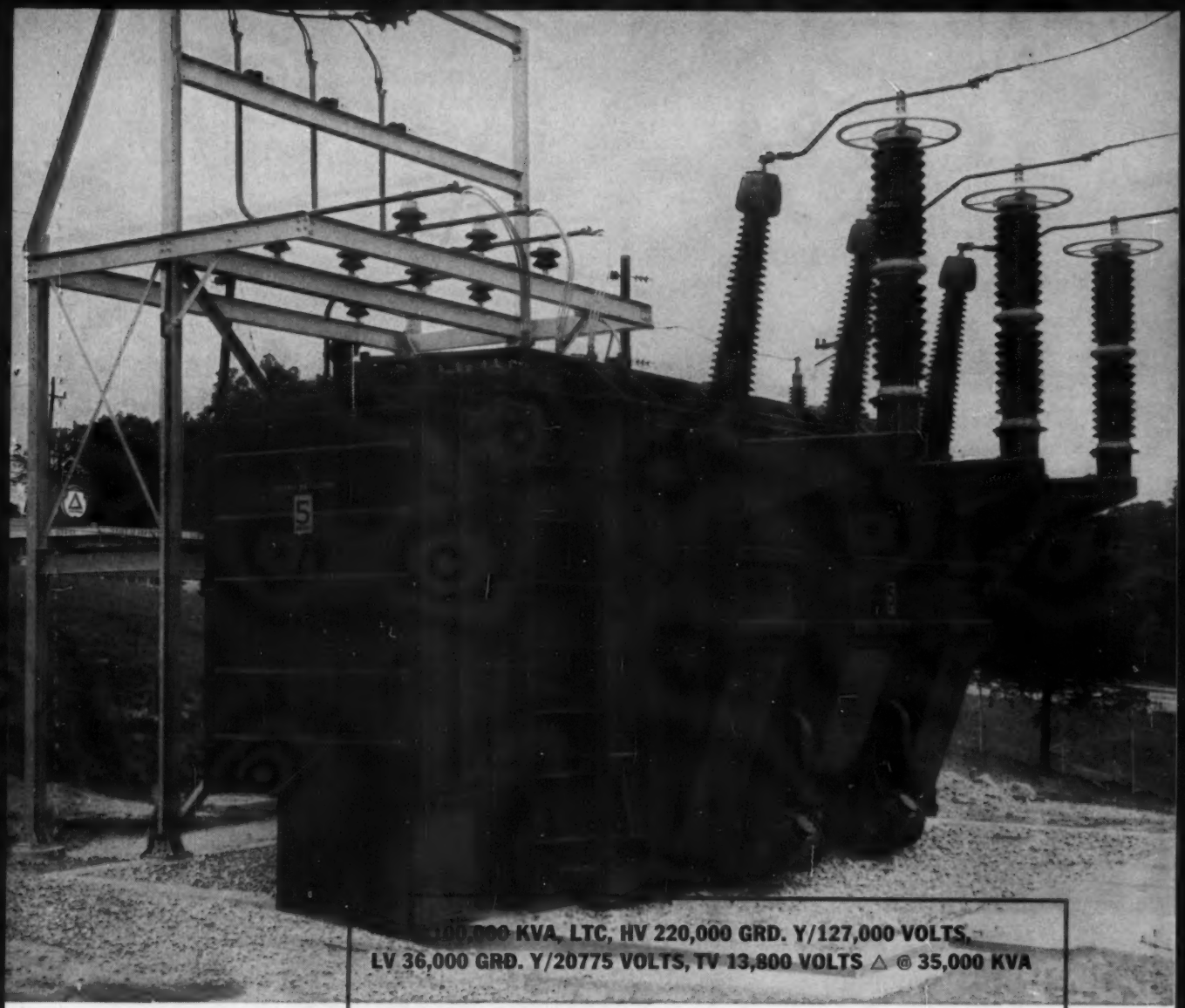
. . . features extra-long contact areas, additional conductor encirclement, and a soft, pure-aluminum spacer bar to minimize conductor "cold flow" and assure a low-resistance connection. The HN Series of larger units may be installed by one man. They are designed to meet the demand for a hot-line connector with sufficient current-carrying capacity for main-line connections and fault currents associated with these applications. The tap is securely attached; the connector has large ears or lugs for a positive grip in all makes of hot sticks. A broad hook makes the initial contact easily and remains in position without twisting during installation.

Fargo Manufacturing Co, Inc, 845 Main St, Poughkeepsie, N. Y.

Chemical Compound . . .

. . . gives birds and animals a "hot foot", keeping them away from switchgear, transformers, pole switches and substations. Applications of "Roost No More" compound are guaranteed for a full year, are said to be still effective after five years. Rain and snow reportedly won't wash it off. It comes in 1-gal or 5-gal cans or in 55-gal drums or 10-in. caulking gun cartridge. One gal, applied in $\frac{1}{16}$-in. minimum thickness with spray or brush, is said to cover 200 sq ft. The caulking gun cartridge spreads paste in a strip 18 ft, ½ in. wide and ½ in. thick.

American Crossarm & Conduit Co, 7726 Sheridan Rd, Chicago 26, Ill.



,000 KVA, LTC, HV 220,000 GRD. Y/127,000 VOLTS,
LV 36,000 GRD. Y/20775 VOLTS, TV 13,800 VOLTS △ @ 35,000 KVA

Power on the Potomac

100 MVA, 220 KV, Moloney LTC Transformer installed at Potomac Electric Power Company's Takoma Substation #27. This unit was placed into service by PEPCO in 1960, ten years after they had installed Moloney's first LTC Transformer, a 3750 KVA unit. The design principles of Moloney LTC are still the same and have been proven by a decade of service. Two of the main principles of Moloney LTC are:

1. All arcing is confined to special arcing contacts on the load transfer switch eliminating maintenance of selector switch contacts.

2. The exclusive, patented, reactor by-pass arrangement eliminates reactor loss and reduces voltage drop on non-bridging positions.

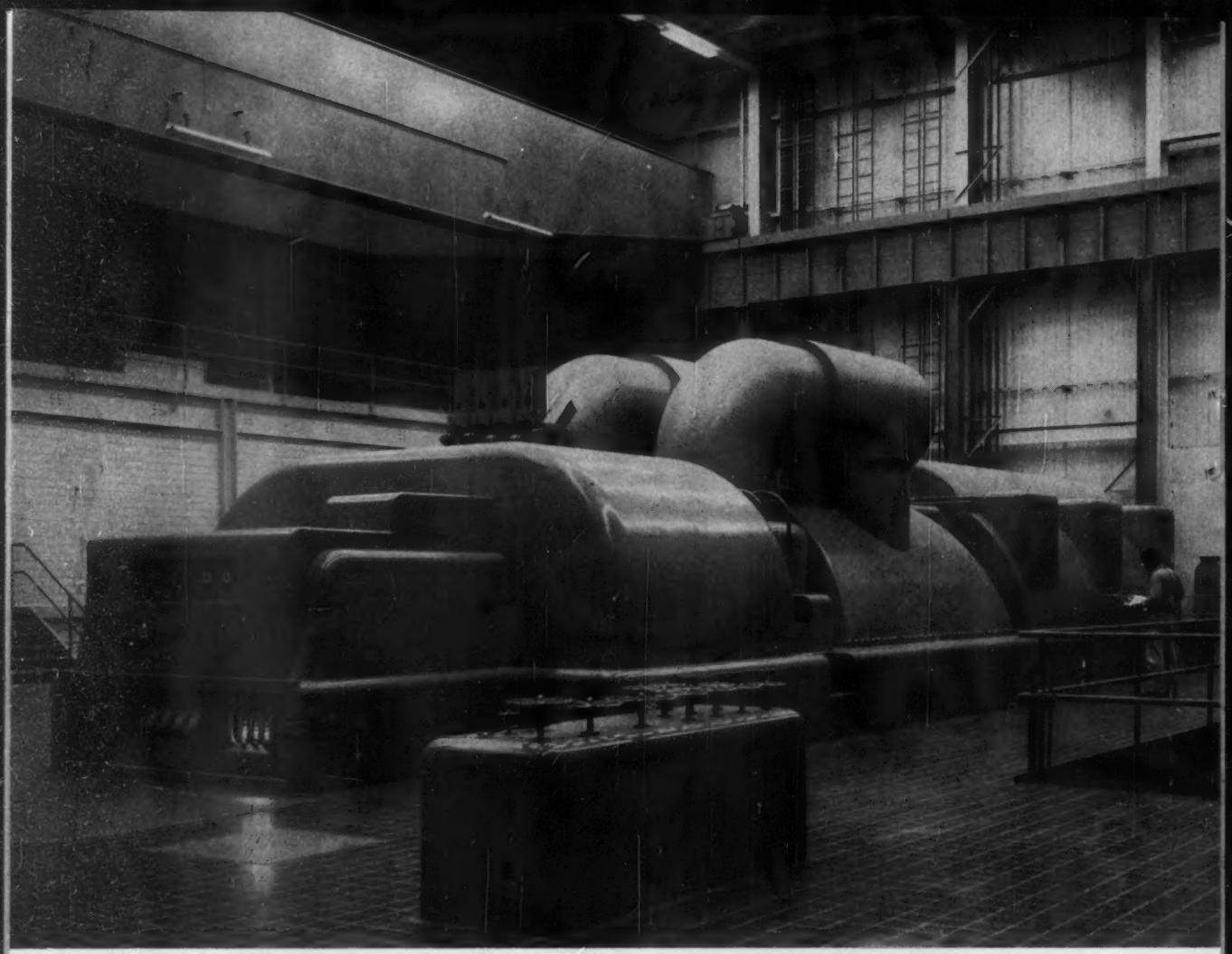
For additional information on Moloney LTC equipment request Bulletin LTC 2907. Contact your local Moloney representative on all transformation requirements.

ME01-6

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry and Electronic Applications

FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA



Complete service complements product reliability when you install a General Electric steam turbine-generator such as this 125,000-kw, tandem-compound, double-flow, reheat unit in the E. D. Edwards Station of Central Illinois Light Company

Always an evaluation factor— General Electric's personalized turbine-generator service

General Electric's complete service program for steam turbine-generators is personalized to your specific system requirements—to help you in your continuing efforts to produce reliable, low-cost electric power. This nation-wide service is readily available, to give you:

- turbine and generator engineering consultation
- installation planning and direction
- accelerated, on-time start-ups
- training of your personnel
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- priority repair service

At General Electric, service is always part of the total value you receive . . . it is not curtailed when prices are soft, when orders are slow, when profits are down . . . it is *always* part of your steam turbine-generator. 244-02

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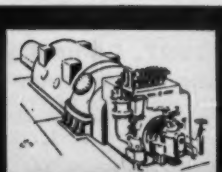
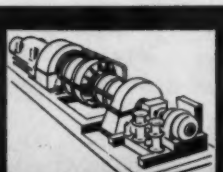
General Electric Turbine-Generators Help Keep Power Costs Low

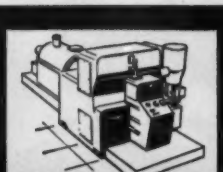
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles

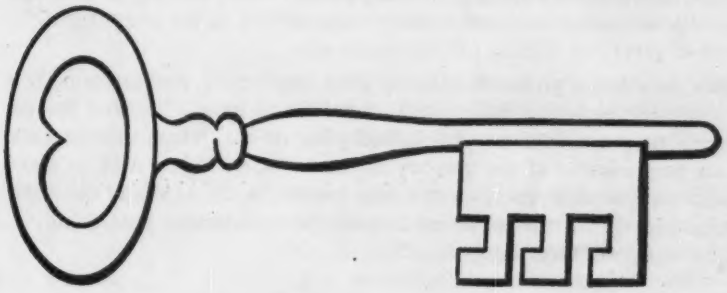


Mechanical drive steam turbines for auxiliaries

Electrical World

SEPTEMBER 11, 1961

Management Newsletter



turn-key job. Any job or contract in which the contractor agrees to complete the work to a certain specified point, and to assume all risk.

Webster's New International Dictionary, Second Edition, Unabridged

Where Does Turn-Key Stand? (Part 2)

A top level executive from one of the major electrical manufacturing firms estimates that the manufacturers' motives behind turn-keys are "one-third commercial, two-thirds engineering." He was, of course, referring to the reappearance last year of manufacturers' fixed-price turn-key contracts in the US electric utility market.

Two contracts were signed last year in which manufacturers agreed to build a steam plant for their customer, to have sole responsibility for the construction and performance, and to assume all the risks.

As was pointed out in the Management Newsletter last week, there were many factors involved with the reappearance of these turn-keys. And their reappearance has touched off a debate within each of the various segments of the electric utility industry (the utilities themselves, their engineering consultants, and the suppliers of utility equipment) over the need and significance of turn-keys, past, present, and future.

In this second and concluding Management Newsletter on the subject of turn-keys, the focus will be on the debate itself and the pros and cons involved.

Down the years, utilities, manufacturers and consultants have contributed to the evolution of steam plants. Which has contributed the most? And does the answer to this question lead to a clear-cut projection of which of the three, if indeed any one of them, should have the prime and sole responsibility for cost and performance of future steam plants?

First, of course, the question can't be answered properly. Certain utilities definitely have been in the forefront of progress; some have not used consultants at all and feel that they have prodded manufacturers forward far more than manufacturers have prodded them. It is this group whom consultants feel they can help the least, unless these utilities grow complacent, insular, and ingrown in their approach. Manufacturers also tend to view these utilities in the same light.

Such utilities have had a profound effect on plant engineering, and assuming that they get continued leadership from within, they should have little need for the manufacturers' or consultants' turn-keys, fixed price or not. These utilities, incidentally, are very scornful of the turn-key method: "Now all you need to know is a phone number to get a plant. . . . If it goes haywire in the middle of the night, who (what person) do you get out of bed to fulfill the performance guarantee? . . . who pays for lost revenue on outage? . . ."

Most consultants feel that their clan, devoid of any commercial motivation (at least back in the professional, fee-relationship days), has done the most to advance the art. Basically, they state that since the manufacturer's prime motive is to sell apparatus, he can't take the objective over-all view necessary to get the best balance among cost, quality, and advancement. While a good engineering-oriented utility can do this, most of them badly need the wide-based experience of a consultant steeped in a wide range of changing conditions. The average utility, they say, will become stale and ingrown without the stimulating cooperation of a consultant. And they say they have carried the changing aspects of a wide range of utility needs to all the manufacturers, acting as clearing house and a stimulus in both directions.

In addition, a majority of the consultants credit the tremendous gains in plant technology to the uncommercial relationship of the old days. This relationship put quality far above cost in steam plant design, and in the long run this has provided superb cost results, they say, while maintaining the rigid quality standards that make the US utility unequalled in reliability the world over.

The integrated engineer-constructor consultant is willing, in various degrees, to undertake turn-key, but the straight consultants see difficulty, obviously. Perhaps a handful would be ready today to fight the manufacturers actively should it come to that. There's no doubt that they feel their existence would be at stake should manufacturers' turn-keys become prevalent.

With this, the integrated manufacturers disagree, pointing out that they would need engineering consultants to work actively with them in preparation of proposals and in detailed engineering work on subcontract. But many consultants think it would be but a matter of time before manufacturers would have their own engineering organizations, organized to give them fullest control over engineering aspects of the projects.

Many manufacturers' engineers generally acknowledge the contribution of the consultant to the art of synthesis (systems engineering applied to plants, in this case). But at today's pace of equipment development, these engineers believe this art cannot proceed fast enough to keep up with technological change unless it is in the hands of those most closely acquainted with the patterns and details of the changes. Many manufacturers' engineers think the time is ripe for them to move back into the field. And they are not sure that they should stop at the steam

plant boundaries, since *systems* engineering in the ultimate would go all the way from the fuel pile to the consumer's meter.

But almost all knowledgeable top manufacturing managements in integrated companies are quite cautious. In the long run, they reason, the utility customer will have to decide whether this is the right path to follow. At this stage, it's the job of the manufacturer to place before the customer the alternatives, the possibilities, to permit him to assay the pitfalls and the advantages.

The large manufacturers do feel that they are gradually growing stronger in their ability to move in this direction—largely due to experience with nuclear plant design and with more and more overseas turn-key conventional stations—and with plants like the OG&E and Tesco cases of last year.

But they don't underrate the tremendous changes it would make in the utilities which accept this approach.

Even aside from the top engineering utilities, the other utilities have no desire to relinquish overall power system design to an outsider in the foreseeable future. This would certainly relegate them to the role of straight operating company, especially at a time when they now see their own role of controlling their own engineering destinies being opened up by exciting new developments.

Insofar as steam plants alone are concerned, there's a wide difference of opinion. The advent of strong, cost-conscious, non-engineering top management in many utilities has frequently caused conflict between the top and the engineering and operating groups, especially when long-held tenets have been questioned. Some of these managements, unable to get satisfaction from their own people, it is felt, are anxious to turn to outsiders, even beyond consultants long associated, to get other views with the hope of cutting costs.

They see in manufacturers' turn-key bidding the lever to obtain such independent information, often from several sources simultaneously. Others feel they can get the same results by bidding various consultants against each other, but more than one feels that the stimulus, or the threat, of bringing in manufacturers can keep the consultants from growing complacent.

But a large utility's president, a non-engineer, simply believes that in the light of today's pressure to hold costs, "all methods of purchasing and construction should be considered before a new unit is ordered and built. Economic facts, rather than philosophy, should determine the course of action in each case."

From the viewpoint of the small, non-integrated manufacturer, there is of course a feeling of resentment, of helplessness, toward any battle of the giants over turn-key. In cases where the large manufacturers also make his equipment, he doesn't stand a chance in any plant which would go manufacturers' turn-key, unless he teams with other small manufacturers and perhaps seeks off-shore help for major equipment that none of them makes.

The large manufacturers, and to some extent the utilities, think the small suppliers are unnecessarily worried. The normal business flow, they reason, would tend to equalize any loss of business by the small suppliers on steam plant turn-key by giving them a better break on non-steam plant business. And there's little feeling that much more than a fraction of total steam plant business would ever go turn-key even if the approach gained favor.

There will always be that group of strong engineering utilities who will never accept turn-key, and on balance, a good many others would be going to consultants' turn-key or staying on the "do-it-yourself" basis.

Meanwhile, the US Justice Department has put forth consent decrees under the antitrust civil suits against the electrical equipment manufacturers which contain an interesting clause on package bidding during the term of the decrees.

This clause requires any manufacturer bidding on a single-price package which contains equipment for which he's under decree to notify the buyer just how much of the price of the package he is alloting to that equipment. For a large manufacturer under several such equipment decrees, this would mean inability to take a sharp price disadvantage on such equipment without letting it be known. Justice's intent undoubtedly is something different: it wants information on record on such equipment transactions for some period of time. But the effect, on turn-key bidding, if a buyer's market is in effect and plant prices low, will be something else again.

Utilities taking such bids might be encouraged to shop around to get even lower prices on such equipment, thus fragmenting the package bid. It's expected that major suppliers would resist such fragmentation, and this might militate against manufacturers' turn-key if indeed the prime motivation on the part of the manufacturers were commercial.

Finally, would turn-key stimulate or stifle progress?

Taking it out of the realm of purely commercial motivation, those who favor turn-key as a new approach in the exciting business of designing systems see it as a stimulating new approach, opening all kinds of new avenues. Those who see the high costs of bidding and who believe that the only way to meet them is to standardize designs see it as a stifling influence.

Some in the middle see the turn-key approach using standardized plant designs as an ideal cost-cutting answer for the medium to small utility which can use plants not in the forefront of technology.

But few think that the big, super-efficient stations in the vanguard of innovation can afford any standardization in the true sense of the word. Most believe that for these stations the combined efforts of manufacturers, utilities and consultants will be needed to keep things moving and at overall costs which have a long-term downward droop. If turn-key can fit into this prescription, there may be a place for it.

So manufacturers' fixed-price turn-key, after two brief flares in the steam plant field, has turned quiescent. Will it stay that way, or will it flare up again? Is it destined to become a significant factor?

At this point, there is really no absolute way to say. One manufacturer said, just before the storm lulled, "It will take five to ten years to assay the net effect, the acceptance."

Meanwhile, in the words of one of the principals involved in last year's turn-keys, "If the recent turn-key flareup did nothing else, it should cause others to shake off a calm and comfortable complacency." Put another way, the significance of last year's contracts was not so much the contracts themselves, but the debate which they touched off.

And equally as important as the appearance of turn-keys last year, is their disappearance right now. Whether this disappearance is temporary will depend in large measure on whether the motives behind turn-key are "one-third commercial, two-thirds engineering." If this estimate is correct, then turn-keys will probably reappear. If they don't then perhaps the correct estimate should have been "two-thirds commercial, one-third engineering."

From regulator to lamp

. . . use cost-saving

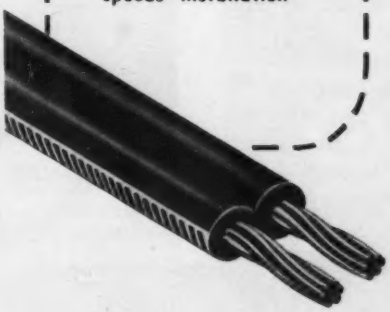
SUPERIOR CABLES

Thermoplastic Series Lighting Cables

- High resistance to earth acids and alkalis
- High resistance to sunlight, moisture, weather
- Small diameter, lightweight
- Easy to splice

Figure 8 Pole & Bracket Cable

- High resistance to abrasion, mechanical damage
- Does not deteriorate with age or weather
- Will not support combustion
- Flexible, strips clean, speeds installation



Performance and economy go hand in hand with SUPERIOR plastic insulated and jacketed cables.

All SUPERIOR CABLES are quality-engineered, precision manufactured and thoroughly tested.

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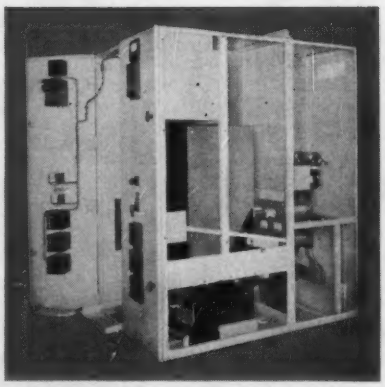
More features make Westinghouse metal-clad switchgear

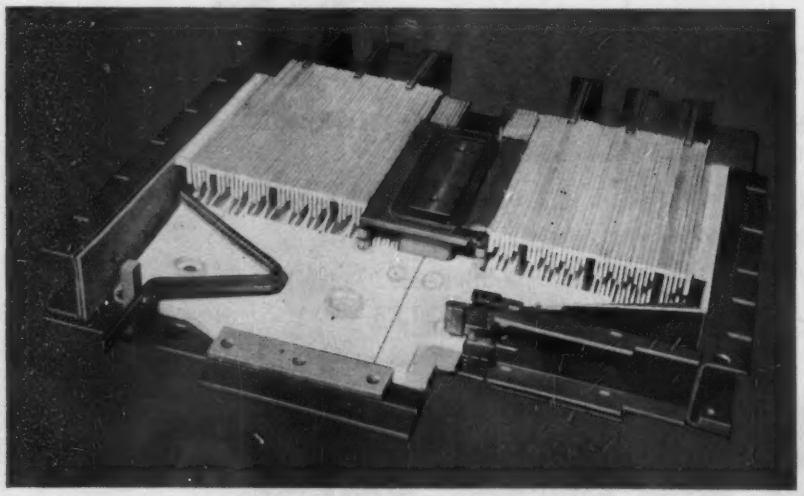
Westinghouse metal-clad switchgear is design proved in the Westinghouse High Power Laboratory. It meets all industrial, electric utility, commercial, institutional, and other needs for 75 to 1000 mva service inclusive, 4.16 through 13.8 kv.

Check below for advantages of this equipment that are of major importance to you.

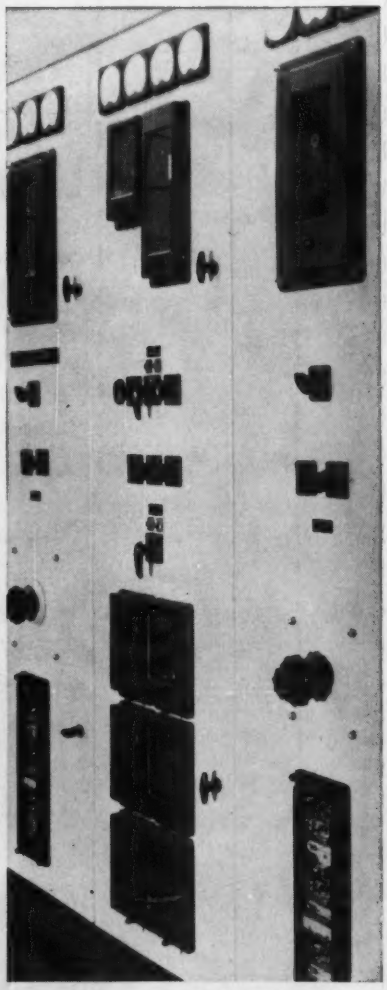
For further information, call your Westinghouse representative or write for a copy of Descriptive Bulletin 32-250 to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*



Balanced insulation protection is provided by the exclusive "Limitrak" insulation system on bus supports, arc chute enclosure and breaker bushings.



Fast, positive circuit protection is provided by the De-ion principle of arc interruption with center coil arc chute design.

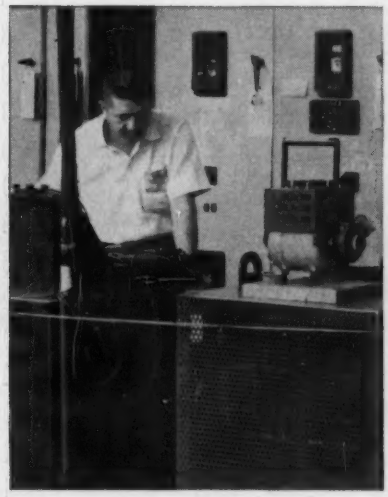


Adequate space for varied relaying and instrumentation is assured by full height front panels.

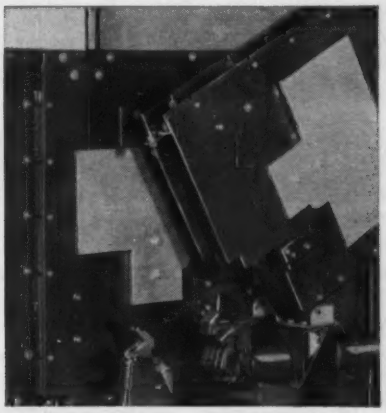
your best buy

Simple, quick inspection, maintenance and replacement of DH breakers is made possible by horizontal drawout construction.

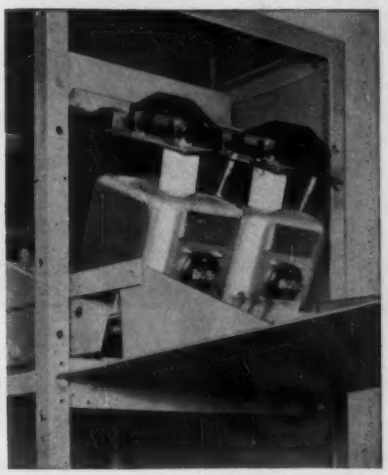
Complete joint sealing with polyester compound at main contact supports and main bus provides full insulation.



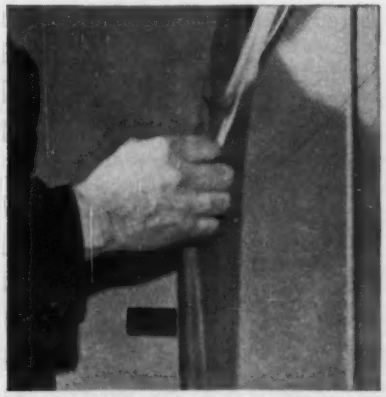
Proper component functioning is verified by a continuing program of production inspection and testing.



Hinged arc chute permits easy tilting for inspection and maintenance of contacts with DH breaker in drawout position.



Personnel are protected by separate compartment drawout-type mounting of potential transformers.



Front panel is protected during assembly, shipment and installation by strippable plastic coating.

Thorough phosphatizing and priming treatment safeguards against corrosion and provides a superior base for finish coat.

Westinghouse

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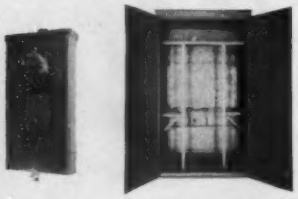

Convert-A-Socket Meter Booth

Write for a free Catalog outlining types and sizes of enclosures, reactiformers, test switches, test blocks, and meter socket equipment.

Selling

Final Plans Being Made For EW Heating Conference

Final arrangements are now being made for the Fifth *Electrical World* Electric Heating Conference.

The two-day meeting, scheduled for the Sheraton-Park Hotel, Washington, D.C., on September 25 and 26, is expected to draw key officials from electric utilities, electrical manufacturers, government housing agencies, and allied trade groups.

In addition to speakers announced in the last three issues of *Electrical World,* other top speech-makers have been lined up.

Fred H. Sides, National Mineral Wool Insulation Assn, and G. A. Erickson, Wood Conversion Co, will talk on "What Will Proper Insulation Do For Electric Heating?" A panel composed of Paul W. Emler, American Electric Power Co, C. B. Osborne, Electrical Power Board of Chattanooga, V. A. Rydbeck, General Electric Co, and Walter Brown, Middle West Service Co, will discuss how "Distribution Can Help Sell Electric Heating."

A panel of members from the government housing agencies will tell "Where Do You Figure in the Administration's National Housing Plans?" William J. O'Connor, Deputy Director, Architectural Standards Division, will represent the Federal Housing Administration, Arthur Dunstan, Chief Utility Officer, the Public Housing Administration, and Edward S. Dulcan, Senior Field Coordinator, the Urban Renewal Administration.

Utility Prepares Appliance Service Book

A booklet which lists all the appliance service men in its territory has been prepared by the Atlantic City Electric Co.

Sources of appliance service are listed alphabetically by counties.

The booklets are available in the utility's customer offices and are given to all appliance dealers to distribute with each sale of an appliance.

Dealers who service small appliances are indicated.

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Save you money 4 ways

PENGO HEAVY-DUTY Twin Helix Augers—14" through 96" hole diam.

1 **BORE FASTER**...put real "teeth" in earth drilling, save wear and tear on your diggers.

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3 **COST FAR LESS TO MAINTAIN** ...reversible teeth cost only 90¢ each, pilot bit only $8.00. Parts interchangeable on all PENGO augers you are using...less inventory!

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(even salt water); can't mildew or rot. Excellent dielectric properties.

PENGO-Prope is a synthetic rope of special construction available in all popular diameters from 1/16" to 2"; regular construction in sizes smaller than ¼". Write for specifications, prices.

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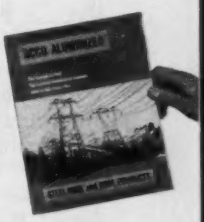
Here is more proof—perhaps the most convincing yet—of the superior corrosion-resistance of ACCO *Aluminized* Steel Core Wire for ACSR. The three specimens of 6/1 ACSR above have recently been removed from a West Coast test site where they were exposed to a severe salt atmosphere for *more than 2½ years!* Yet the ACCO *Aluminized* core (bottom) is almost completely free of corrosion. Compare this with the corrosion evident on the other two samples (Class A galvanized at the top and Class C galvanized in the center). None of the three specimens has been cleaned, nor has the photograph been retouched.

This latest test again demonstrates how you can minimize losses due to corrosion by using ACCO *Aluminized* Steel Core Wire. Another advantage—eliminates danger of electrolytic action.

You can also minimize losses due to corrosion when you specify ACCO *Aluminized* steel strand for GUYS—MESSENGER—and OVERHEAD GROUND WIRE purposes.

ACCO *Aluminized* wire is commercially pure aluminum bonded to a steel wire. When you specify ACCO *Aluminized*, you get the strength of steel plus the corrosion-resistance of aluminum—produced by a manufacturer with 50 years experience in the development and manufacture of wire for utility service.



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For details, write us at Monessen, Pa., for a copy of Booklet DH-537

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the source for answers to wire problems

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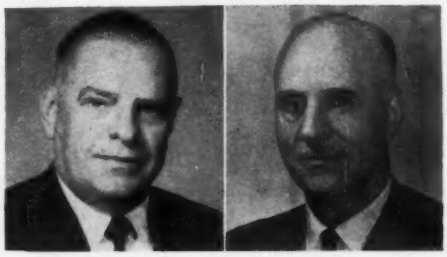
VEPCO Promotes Two to Vice Presidencies

Virginia Electric & Power Co has appointed S. E. Ratcliffe and George F. Duborg as vice presidents. Ratcliffe continues as treasurer. Duborg will succeed Ray C. Hopkins when Hopkins retires in October as vice president of the western division.

In the utility field since 1917, Ratcliffe was assistant treasurer of Engineers Public Service Co and its subsidiaries, including VEPCO, at the time EPS was dissolved in 1947. He then became assistant treasurer of VEPCO and was made treasurer in 1953.

Duborg began his utility career with Stone & Webster, Inc. He joined EPS in 1935 and was named VEPCO's Norfolk manager in 1952. He was most recently Blue Ridge district manager.



RATCLIFFE DUBORG

PERSONAL BRIEFS

The Atomic Energy Commission has reorganized its reactor development division and established three associate directorships and four additional assistant directorships. The new associate directors are **U. M. Staebler,** power applications; **Nelson F. Sievering,** advanced systems; and **Hugo N. Eskildson,** operations. The assistant directors are **Donald H. Stewart,** civilian power; **Richard P. Godwin,** maritime reactors; **Col William C. Gribble,** Army reactors. **Col William A. Tesch** (USAF) will report to Sievering as assistant director for experimental concepts and assistant director for compact power systems.

Electric Power Board of Chattanooga has promoted **Frank W. Floyd** to assistant chief engineer and **W. A. Campbell** to engineer-overhead lines in the Board's engineering department.

Wisconsin Michigan Power Co has named **William E. Raffin** superintendent of power production.

At Union Carbide Corp, **Richard S. Abrams** has been appointed manager of development for Union Carbide Olefins Co division, and **James C. Malone** was named general manager of the silicones division. **William C. McCosh** became director of marketing for National Carbon Co division, succeeding **Curry E. Ford** who was appointed director of development for the company.

Sylvania Electrics Products Inc has formed a microwave device division and appointed **W. Herbert Lamb** as vice president of the new division. Sylvania is a General Telephone & Electronics Corp subsidiary.

Radio Corp of America has appointed **John E. Johnson** as staff vice president. He will be responsible for handling special sales assignments, and will make his headquarters in the Boston area.

Square D Co's new manager of the electric controller and manufacturing division is **Paul R. Goudy.** He succeeded **Wilbur H. Peter Jr** who resigned. **Robert C. Mierendorf** became chief engineer of the industrial controller division.

Ronald F. Morrison has stepped into the position of administrative assistant in the office of the chairman of International Business Machines Corp. He succeeded **John F. Williams,** recently named director of stockholder relations.

John J. O'Donnell has become manager of circuit packaging and standards engineering in the commercial systems department of RCA's electronic data processing division.

Western Precipitation division of Joy Manufacturing Co has appointed **Norman Block** as director of engineering and research.

Robert Farnsworth has been named Midwestern engineering product specialist for Sprague Electric Co's resistor division. Farnsworth will serve as application engineering specialist to back up Sprague Electric sales representatives and district offices in the Midwest.

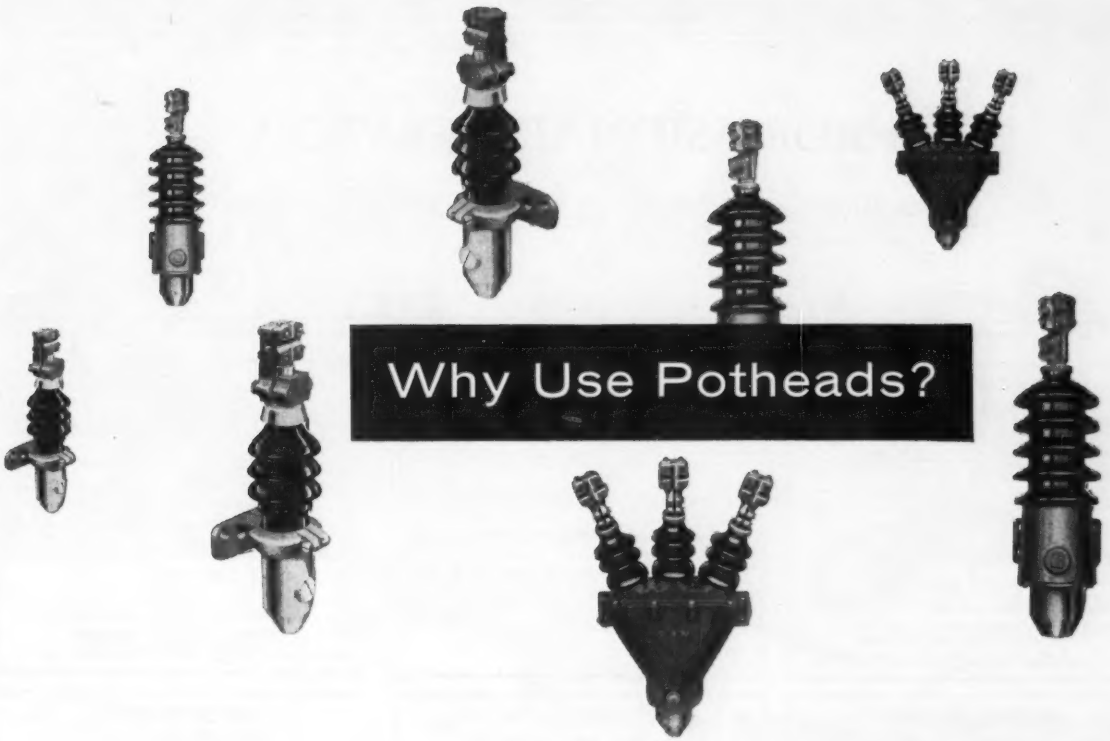
General Electric Co has appointed **Lawrence B. Miller** as manager-manufacturing administration and plant facilities for the industry control department, Salem, Va. He replaced the late **Robert M. Schilling.**

Neuhoff Promoted by GE In HV Switchgear Section

Justin Neuhoff has been appointed engineering manager for General Electric Co's high-voltage switchgear department, Philadelphia.

NEUHOFF

Neuhoff has been manager-power plant design at GE's aircraft nuclear propulsion department for the past three years. From 1951 to 1958 he was engineering manager for the commercial and industrial air conditioning department. He joined GE in 1950 as manager for development engineering in the air conditioning department.



Why Use Potheads?

Because—— Potheads are the best way yet devised to terminate cables.

Why?—— Only a pothead provides a grounded, hermetically-sealed metallic housing over the bare cable for effective protection against weather and corrosive atmospheres. Extra insulation between conductors and to ground is built up in potheads with dielectric materials of high strength, amply protected by the housing against deterioration. Mechanical seal of cable to pothead is excellent, making it easy to secure cable termination solidly.

True—— There are other methods of terminating a cable. These are good and may be entirely adequate for certain conditions. But only a pothead has the extra characteristics that pay off in best service over the years.

What Extras?—— Potheads are best because they have extra features to enhance life, reliability, and continuity of service, while requiring minimum maintenance. They have extra stamina, too, for the difficult situations and for emergencies such as switching and lightning surges, corrosive salt and industrial fumes, and unusual cable-support problems.

G&W—— Standardized potheads covering 80 percent of uses are available for fast off-the-shelf delivery. Other potheads are available for special uses or can be designed for even the most unusual cases. Other types of termination are also available. Write G&W about your problem or contact your nearest sales representative. Data is available on both standard and special-use potheads upon request.

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IN U.S.A. A model of the runner for one of the eight 90,300 h.p. propeller turbines to operate at a head of 67 feet. These are being built in Canada for Big Bend Reservoir, South Dakota.

Power from 'Muddy Waters'

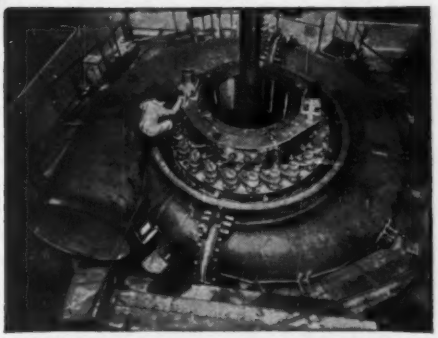
In the land of the old Dakotas (one of the confederated tribes of the powerful Sioux) rises a new dam at Big Bend Reservoir on the Missouri River whose yellow flow near its mouth gave rise to its name, 'Muddy Waters'.

Harnessed by the U.S. Army Corps of Engineers, these waters will provide electric power for the development of industry and agriculture throughout South Dakota and other states in the Missouri River Basin.

Eight propeller water turbines for this project are now being built in Canada to 'ENGLISH ELECTRIC' designs by John Inglis Co. of Toronto, a member of the world-wide 'ENGLISH ELECTRIC' Group of Companies.

Amongst the notable hydro power stations in North America equipped by 'ENGLISH ELECTRIC' are Beauharnois No. 3 and Robert H. Saunders on the St. Lawrence; Priest Rapids and McNary on the Columbia; Table Rock on the White River, Missouri; Chute-des-Passes and Bersimis in Quebec; and the Canadian Niagara pumped-storage station.

With factories in five continents, the Group is near at hand to any undertaking needing power engineering and can provide anything from a small individual drive to a comprehensive scheme with generating plant using steam, water, gas, oil or atomic energy.



IN WALES Works assembly of one of four 105,000 h.p. Francis turbines for a head of 970 feet, to be installed at Ffestiniog Pumped-Storage Station.

IN AUSTRALIA. Four high-head Francis turbines and a spare runner supplied to the Tumut 1 Station, Snowy Mountains. These turbines, which can deliver 129,000 h.p. at 1,065 feet head, are amongst the most powerful at this head in the world.

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Agents: ENGLISH ELECTRIC CORPORATION, 750 Third Avenue, New York 17, N.Y. Telephone: MURRAY HILL 7-0303

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FOR MASSACHUSETTS, RHODE ISLAND, MAINE, NEW HAMPSHIRE AND VERMONT	Flagg, Brackett & Durgin, Inc., 183 Essex Street, Boston 11, Massachusetts. Tel: HUbbard 2-4120
FOR SOUTHERN FLORIDA	Charles R. Lee & Associates, Inc., 3796 West Flagler Street, Miami 44, Florida. Tel: HIghland 4-7414

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Books

Books Recently Received

The Fourteen Systems of Units, by William R. Varner. Published by Vantage Press, Inc, 120 W 31st St, New York 1, N. Y. 162 pages, illustrated. Price $3.95

Tensor Analysis of Electric Circuits and Machines, by L. V. Bewley. Published by Ronald Press Co, 115 E 27th St, New New York 16, N. Y. 276 pages, illustrated. Price $12.00.

Magnetic Control of Industrial Motors, Part I: A-C Control Devices and Assemblies, by Gerhart W. Heumann. Published by John Wiley & Sons, 440 Park Ave South, New York 16, N. Y. 276 pages, illustrated. Price $9.00.

Magnetic Control of Industrial Motors, Part II: A-C Motor Controllers, by Gerhart W. Heumann. Published by John Wiley & Sons, 440 Park Ave South, New York 16, N. Y. 336 pages, illustrated. Price $9.00.

Introduction to Electrical Engineering Science, by Harold A. Toecke. Published by Prentice-Hall, Inc, Englewood Cliffs, N. J. 786 pages, illustrated. Price $15.65.

Swedish 380-Kv System, by Swedish State Power Board. Published by Kungl. Boktryckeriet P. A. Norstedt & Soner, Stockholm, Sweden. 354 pages, illustrated, in English.

Electromechanical System Theory, by Herman E. Koenig and William A. Blackwell. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 506 pages, illustrated. Price $14.50.

Water Treatment For Industrial and Other Uses, 2nd Edition, by Eskel Nordell. Published by Reinhold Publishing Corp, 430 Park Ave, New York 22, N. Y. 600 pages, illustrated. Price $12.00.

Theories of Engineering Experimentation, by Hilbert Schenck, Jr. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y. 242 pages, illustrated. Price $7.00.

Guide to US Government Statistics, 3rd Edition, by John L. Andriot. Published by Documents Index, Box 453, Arlington 10, Va. 406 pages, illustrated. Price $15.00.

Transform Calculus for Electrical Engineers, by Roger Legros and A. V. J. Martin. Published by Prentice-Hall, Inc, Englewood Cliffs, N. J. 344 pages, illustrated. Price $12.00.

Water Supply: Economics, Technology, and Policy, by Jack Hirshleifer, J. C. De Haven, and J. W. Milliman. Published by University of Chicago Press, Chicago, Ill. 383 pages, illustrated. Price $7.50.

Engineering Drawing & Geometry, 2nd Edition, by R. P. Hoelscher and C. H. Springer. Published by John Wiley & Sons, Inc, 440 Park Avenue South, New York 16, N. Y. Illustrated. Price $8.95.

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(*Continued from page 51*)

Studies indicated that instead of providing all of the cycle storage in the deaerator storage tank, it was more economical to provide about half in the storage tank and half by means of a high-capacity, distilled-water pump supplying to the deaerator from the distilled-water reservoirs.

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Meetings Calendar

SEPTEMBER

National Rural Electric Cooperative Association—Region III Meeting, Admiral Semmes, Mobile, Ala, Sept. 25-26; Region I Meeting, Richmond, Virginia, Sept. 28-29.

Edison Electric Institute—Meter and Service Committee, Hotel Leland, Springfield, Illinois, Sept. 24-27; Industrial Relations Committee, Annual Round Table Conference, Drake Hotel, Chicago, Sept. 25-27.

Southeastern Electric Exchange—Accounting Section Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Sept. 28-29.

American Institute of Electrical Engineers—Petroleum Industry Conference, Jung Hotel, New Orleans, Sept. 17-20.

NEMA—Technical Committee, Power Circuit Breaker group, NEMA office, New York City, Sept. 19; Codes and Standards Committee, NEMA office, New York City, Sept. 28-29.

Electric Companies Public Information Program—1961 Workshop Conference, Brown Palace Hotel, Denver, Sept. 20-22.

Northwest Electric Light & Power Association—54th Annual Meeting, Sheraton-Portland Hotel, Portland, Ore., Sept. 20-22.

Missouri Valley Electric Association—Accounting Conference, Sheraton-Jefferson Hotel, St. Louis, Sept. 21-22; Sales, Rural and Home Service Conference, President Hotel, Kansas City, Sept. 27-29.

National Power Conference—Sponsored by American Institute of Electrical Engineers, and American Society of Mechanical Engineers, St. Francis Hotel, San Francisco, Sept. 24-27.

Pennsylvania Electric Association—Accident Prevention Committee, Bellevue Stratford, Philadelphia, Sept. 25-26; Annual Convention, Bellevue, Stratford, Philadelphia, Sept. 27-28.

Southeastern Electric Exchange—Accounting Section, Atlanta Biltmore Hotel, Atlanta, Sept. 28-29.

OCTOBER

American Gas Association—Annual Meeting, Dallas, Oct. 1-4.

• **Indiana Electric Association**—Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind., Oct. 4-6.

• **International Association of Electrical League**—Annual Conference, Hotel President, Atlantic City, N. J., Oct. 4-6.

• **Northwest Public Power Association**—Accounting and Finance Section, Annual Workshop. Snohomish County PUD Auditorium, Everett, Wash., Oct. 5-6.

• **Pennsylvania Electric Association**—Electrical Equipment Committee, Penn Alto Hotel, Altoona, Pa., Oct. 5-6; Business Development Section, Bedford Springs, Pa., Oct. 19-20; Meter Committee, Uniontown, Pa., Oct. 19-20.

International Association of Electrical Inspectors—Eastern Section, Annual Meeting, Warwick Hotel, Philadelphia, Penn., Oct. 9-11.

• **National Electronics Conference**—Annual Meeting, Sherman Hotel, Chicago, Ill., Oct. 9-11.

• **American Standards Association**—National Conference on Standards, Rice Hotel, Houston, Oct. 10-12.

• **Edison Electric Institute**—Transmission and Distribution Committee, Ft. Des Moines Hotel, Des Moines, Iowa, Oct. 12-13; Electrical System and Equipment Committee, Jack Tar Hotel, San Francisco, Oct. 23-24; Home Service Committee, Chicago, Ill., Oct. 24-25.

• **American Institute of Electrical Engineers**—Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich., Oct. 15-20.

• **Northwest Electric Light & Power Association**—Business Development Section, Davenport Hotel, Spokane, Wash., Oct. 16-8.

• **National Safety Council**—Annual Meeting, Chicago, Ill., Oct. 16-20.

• **Wisconsin Utilities Association**—Operating and Sales Convention, Schroeder Hotel, Milwaukee, Wis., Oct. 18-20.

Electrical World's Fifth Electric Heating Conference—Sheraton-Park Hotel, Washington, D. C., Sept. 25-26.

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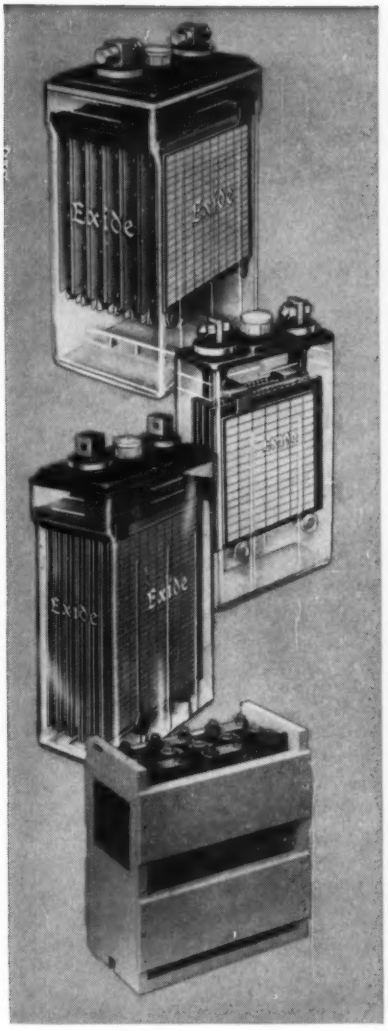

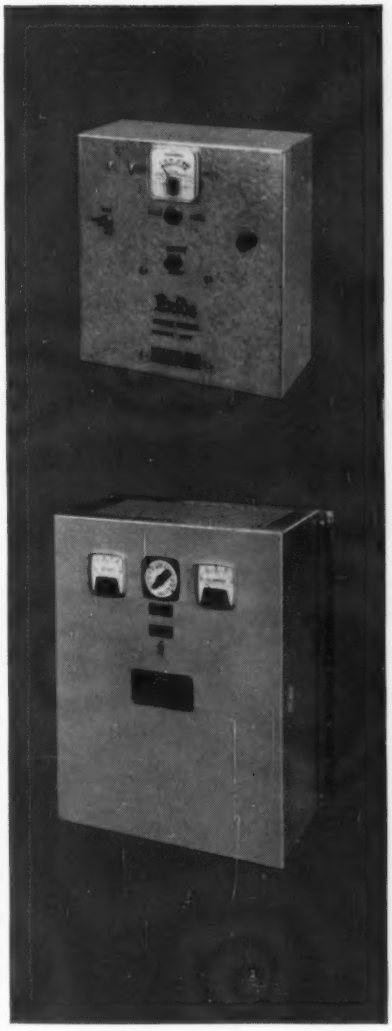

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